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CONTENTS.

Editorial 357
Annual Reception of the New York Academy of Sciences 359
Electric Power on the Brooklyn Bridge 359
Convention of the Texas Street Railway Association 359
Trolley Legislation in New Jersey 359
The Edison Fluoroscope 360
Reflection of Röntgen Rays 360
Oscillatory Currents 360
The Electric Lighting Plant in the American Surety Building 361
A Reason for the Failure of Electromagnetic Regulators 362
Notes on General Electric Alternating-Current Machinery.—I 363
Electrographs, by Walter H. Merrill 367
The National Electrical Exposition 368
The American Institute of Electrical Engineers 368
Is Tesla to Signal to the Stars? 369
Röntgen Ray Nomenclature 370
National Conference on Standard Electrical Rules 373
Tungstate of Calcium Fluoroscope 373
Digest of Current Technical Electrical Literature, compiled by Carl Hering 374
New Books 379
A Kerosene Torch 380
Indicating Switch 380
A Combined Electric and Pumping Turbine Plant 380
A Southern Telephone Exchange 381
Ventilated Dynamo Brush 381
The Hunt Coupling for Transmission Rope 381
Ceiling Fan Motor 382
McGill Connector 382
A New Turret 382
DEPARTMENTS:
Financial Intelligence 383
Special Correspondence 383
General News of the Week 385
Trade and Industrial Notes 386
Personal 387
Business Notices 387
Illustrated Record of Electrical Patents 387

THE NATIONAL ELECTRICAL EXPOSITION.

The list of firms we print elsewhere which are to have exhibits at the National Electrical Exposition to be held in New York City next month assures, undoubtedly, the success of that very meritorious enterprise. This prospect is most gratifying to all who have a pride in their connection with the electrical industry or with electrical science, and the kindly feeling that all such will have for those who have contributed to this worthy presentation to the public of electrical accomplishments will in itself be no small return for the expense entailed. Those who have hesitated to offer their support through a doubt as to whether the Exposition would sufficiently appeal to the trade and public can no longer have reason for adhering to such a course. Though a private enterprise in one respect, to the public it will not so appear, and the management thus far has appeared to take the broadest view of the responsibility they have assumed to make the Exhibition in every sense worthily representative of the electrical arts and science. The Paris Electrical Exhibition of 1881 and that in Philadelphia three years later both gave a wonderful impetus to the electrical industry. The effect of the present one should be similarly beneficial, and to this end every one should feel it a duty to assist.

BARGAINS AND REMNANTS.

Not only has the discovery of Prof. Röntgen added a very important factor to our theories of the ether and its bearings upon light and electricity, but it is proving through the stimulus it has produced in society, one of the greatest educational advances of our time. The zeal with which any new knowledge is sought for and the absorbing interest displayed at the popular lectures thus far given, give evidence of an enthusiasm in this subject which is somewhat remarkable. The popularization of Röntgen rays has gone so far that the large retail stores, those latest monopolies of trade, are seeking to supply the demand and we must expect to hear shortly of bargains and remnants in this new commodity. Just how the rays are to be materialized is to us not quite evident, but this is doubtless an unimportant matter to the shopkeeper. Of course, it will be necessary to provide ray meters, but these we understand can be readily furnished by a certain Westerner. If radiographs are to be taken while the customer waits density meters will probably be found a convenience, for the question of penetration is an important one. The shopkeeper will, of course, have to make it a rigid rule that no rays will be exchanged or money refunded. "X-ray nickel-in-the-slot machines" will soon be the order of the day, but we fear that the inventor will find it difficult to prove priority of invention. However, if he can manage to get his case before Judge Coxe he may feel quite confident of receiving satisfaction. The scientific spirit is becoming blighted, and there appear but two alternatives before its real devotees—either to seek a new field or degenerate to the ordinary level of society.

STANDARD ELECTRICAL RULES.

A thought that occurs in connection with the code of standard electrical rules now under preparation is in regard to the manner in which they will be put into effect when completed. As we have before remarked, it would be little less than a calamity if the code were to be offered to the public with the knowledge that it would not be recognized by the insurance interests, for since the underwriters will be complete masters of the situation, the only result can be the reopening of a strife that happily had largely become a thing of the past. Since the proposed code will probably contain many pro-

visions having no relation to the requirements of an insurance code, it could not as a whole be very well adapted to fulfill the commercial purposes of the latter. A way out of the difficulty would seem to be in offering as amendments to the insurance code now in almost exclusive use throughout the United States, and which furnished the basis of discussion at the recent conference, such changes or additions as agreed upon which affect fire-hazard, and to separately codify other rules—such as those relating to personal safety, etc. It seems quite probable that nearly all the suggestions offered by such an authoritative body would meet with approval from the insurance interests, and the differences that would arise could thus be confined to a few specific and clearly defined cases. This seems a much more rational course of procedure than to place before the public two codes, each discredited by the supporters of the other, when in reality there may be but few points of difference. By confining attention to the latter alone they would become the subject of discussion and investigation to such an extent as to bring out all the points involved, and thereby result in the formation of opinion—for or against—that would finally be accepted.

THE STUDY OF ALTERNATING-CURRENT ARCS.

The paper presented by Prof. Puffer before the last meeting of the Institute, an abstract of which is to be found in another column, is especially commendable from the experimental standpoint. Although the stroboscopic method is one which has been quite extensively employed in other lines of physical investigation, strange to say, it has not apparently been before applied to the study of the alternating-current arc. Owing to the complex and varied conditions under which the studies of alternating-current arc phenomena have been pursued, and also to the insufficient data pertaining to these conditions, the results obtained by different investigators have generally involved serious discrepancies. As has been pointed out by Dr. Duncan and Mr. Freedman, the counter E. M. F. of the arc may be considered as comprising two components, one of which is due to the molecular action of the tearing away of the carbon particles and the other due to the thermal couple produced by the difference in temperature between the carbon vapor and the electrodes. It is evident that both of these components will vary with the mean temperature but not necessarily in the same proportion, and that both, together with the resistance of the arc, will decrease with an increase of temperature, thereby producing with an increase of current an actual decrease of the terminal difference of potential. It is also evident that the temperature of either electrode will not be in phase with the current, but will lag when both are increasing, and be in advance when both are diminishing. The angle of lag between the impressed E. M. F. and the current is, therefore, a variable during a single cycle, and its variation will not only depend upon the current strength, but will be a function of the mean temperature throughout the cycle, the size and distance between the carbon electrodes and the degree of radiation and conviction, all of which are now more or less inter-related. It is for these reasons that the contact method of plotting alternating-current waves under the condition of supplying arc lamps has proved so unreliable. The stroboscopic method, although it does not give the quantitative results which are desired in physical measurements, still offers a method of study which is both instructive and valuable.

RÖNTGEN RAY NOMENCLATURE.

In another column we print an extensive list of opinions from authoritative sources on the subject of Röntgen ray nomenclature, from which it will be seen that the questions presented are not such as admit of any definite answer at the present stage of knowledge concerning the wondrous Röntgen phenomenon. While there is considerable diversity in the various views expressed, yet the three names, radiograph, skiograph and skotograph, seem to meet with most favor, and in the order named. As we have several times remarked, the first-named term has the disadvantage of being too general in its significance, and still another objection is its hybrid derivation. Prof. Goodspeed shows that the latter objection may not be serious, but we doubt if purists would accept the reason offered in support of this view. The other two names above mentioned seem to have the opposite disadvantage of being too specific, and if, as seems most probable, Röntgen pictures as now obtained are due to fluorescent light, they are entirely inapplicable. It would, therefore, appear safest, should any necessity arise for applying a definite name, to use the more general term radiograph for a double reason. First, on account of its generality it could most easily be displaced by a more specific term when such a one is definitely indicated ; and second, the equivocal etymology of the term would also tend to its speedy replacement by a term found more correct, both in this respect and in significance. Perhaps, however, the safest course of all would be to evade the difficulty by using "Röntgen picture," which seems to be the only choice, if the name of the discoverer is to be accorded recognition in this connection, and this, of course, is extremely desirable. After all, it may happen that very shortly the need of a name for Röntgen pictures will scarcely be worthy of consideration, and the discussion will be diverted to the subject of a name for the fluorescent picture produced upon a screen by Röntgen rays. The account in another column of the success attained by Mr. Edison in his experiments with the Röntgen fluorescent screen seems to promise that preference will be given to this method of directly observing the Röntgen effect, in which case Röntgen pictures may be of interest merely to the psychologist in writing of the extraordinary manner in which so many of our professors, upon first becoming acquainted with the existence of Röntgen phenomenon, dropped their science and temporarily reverted to a kindergarten stage.

An Electrical Aerial Torpedo.

Mr. H. G. Rich, an electrical engineer, of Des Moines, Ia., has invented an instrument of warfare which he calls an "aerial torpedo," designed to be used in the siege of cities, or to scatter large bodies of troops while at rest. The torpedo consists of a small sized gas-filled balloon, capable of sustaining for any length of time from 30 to 40 pounds at an elevation of from 500 to 1000 feet above the earth. Inside of the lower or small end of the balloon is placed a metal cylinder, which contains an electrical device, the purpose of which is to ignite the gas in the balloon at any stated period. Underneath the balloon is suspended a case or basket containing high explosives, similar to dynamite, which explodes with terrific force when striking a hard substance, like the earth or walled embankments. In action, the management of the torpedo is described as very easy and simple, the inventor stating that a corporal's guard can with it accomplish what would require a large force to do by the usual methods now employed in the siege of cities, or the scattering of large bodies of troops. The torpedo complete is small and compact, and a large number can be carried by a few men or a pack animal. The gas to inflate the balloon is carried in light metal cylinders, enough being compressed in one cylinder to inflate a large number of the aerial torpedos.

To use the aerial torpedo effectively all that is necessary is to approach as near as possible the locality where the torpedo is desired to take effect, and to ascertain the direction of the lower air current and the velocity of same per hour. The length of time it would take for the air current to carry the torpedo over the objective point can thus be ascertained, and the electrical device set at the proper hour or minute. The balloon part is then inflated, the torpedo released, and the air current will convey the torpedo to the point desired.

As soon as the time has expired as set in the electrical device an electric spark will ignite the gas in balloon, causing it to explode, when the torpedo will drop to earth. The explosive striking the earth or any hard substance will cause serious damage in that locality. In the siege of cities this aerial torpedo, the inventor believes, will be especially effective, as no defence can be made against it, and it can be used in the night as well as day, and by a few men of ordinary intelligence.

May Convention of the National Electric Light Association.

The Central Passenger Committee have granted the rate of a fare and one-third, on the certificate plan, from points in their territory to New York and return, for delegates attending the 19th convention of the National Electric Light Association.

Mr. W. A. Kreidler, of the *Western Electrician*, Chicago, Messrs. Bryan & Humphrey, Turner Building, St. Louis, and Mr. E. H. Heinrichs, of the Westinghouse Electric & Manufacturing Company, Pittsburg, will have charge of transportation matters in their respective localities.

A special party is being organized in Chicago, which will be joined *en route* by delegates along the line. A very large attendance at the coming convention is anticipated.

Annual Reception of the New York Academy of Sciences.

The Third Annual Exhibition of the New York Academy of Sciences, which was held during the afternoon and evening of March 26, in the Halls of the Museum of Natural History, evidenced, by the displays of the various members, an increased enthusiasm in this, one of the oldest scientific societies in America.

The Department of Electricity attracted the greatest attention in the exhibition of Röntgen radiographs, and the results exhibited showed a marked advancement in this all-important field of investigation.

In the evening Prof. Pupin gave a formal lecture on the methods of using Crookes tubes for obtaining Röntgen effects, after which those who so desired were permitted to examine their own bones with the aid of Edison's practical form of the fluorescent screen.

The exhibition, as a whole, showed that the Academy has an important influence in the field of scientific investigation, and that it deserves the hearty co-operation of all who are interested in our scientific development.

Electric Power on the Brooklyn Bridge.

At the meeting of the Brooklyn Bridge Trustees on March 23, Chief Engineer C. C. Martin made a report on the use of electric motor cars for switching purposes at the bridge terminals.

Mr. Martin says that as a result of observation upon the motor car now in use it has been determined to use motors of 25 per cent. greater capacity than those on the present motor car, and to somewhat differently arrange the electrical units in the power-house, and increase their capacity 20 per cent.

With the equipment thus increased, Mr. Martin says that the plant will readily do the switching of trains running on 45 seconds headway, and in case of failure of the cable, it will be capable of running four-car trains at intervals of 60 seconds. The plant required to put the bridge railway system in perfect condition will be a power-house about 100 feet square, engines of a capacity of 2500 horse-power, boilers sufficient to supply steam to them, electrical generators of about 1600 kilowatts capacity, and with all the paraphernalia of a first-class power-house. It is proposed to locate the power-house on property owned by the bridge trustees, and situated at the corner of Dock and Water Streets.

The car equipment will consist of four motors, each of which will be able to exert a draw-bar pull of 1500 pounds, and they will be arranged so that any number of them can be operated independently of the rest. All of the ordinary and well-tested devices will be installed to insure certainty and regularity in the operation of the electrical appliances.

Mr. Martin says that the new power-house and plant complete will cost about $300,000, including the equipment of 20 cars.

The report was approved.

The trustees at their next meeting will submit plans for the new power-house, and on the approval of the same, bids will be advertised for at once.

The executive committee reported that the contract for the equipment of 20 cars with electric appliances had been awarded to the General Electric Company at $3,645 each.

Electric Heating Interests Combined.

Public announcement is made of the closing of the deal between the American Electric Heating Corporation and all the important electric heating companies, by which the absorption of the latter concerns by the one above-named is effected. Mr. Jas. I. Ayer is general manager of the new combination. The matter was referred to in considerable detail in our issue of March 14.

Convention of the Texas Street Railway Association.

The Texas Street Railway Association held its second annual convention in Galveston, on March 18 and 19.

Col. W. H. Sinclair, of Galveston, president of the association, made an address in which he welcomed the delegates to the city, and stated the object of the association.

He referred jocularly to the bicycle as a subject for the consideration of the association. Has the bicycle "come to stay"? was a question, he thought, that should be settled at this meeting.

The real business of the meeting was then taken up, and the subjects considered were track repairs, overhead construction, engines, fire insurance, treatment of ties with preservatives, and street railway traffic stimulators, such as public parks and other like resorts.

The question of track construction and repairs received considerable attention. It was generally conceded that the T-rail was the most satisfactory type to use, and all managers advised heavier rail construction.

A permanent committee on fire insurance was ordered. The committee will consider this important question in every relation to street railway operation.

The election of officers for the ensuing year resulted as follows: President, Wm. H. Sinclair, of Galveston; vice-president, C. F. Drake, Austin; secretary, C. L. Wakefield, Dallas. These gentlemen, together with George P. Hendricks, of Fort Worth, and A. H. Hayward, of Houston, will constitute the directory.

The Committee on Insurance, appointed by the president, is as follows: C. F. Drake, of Austin; H. C. Chase, of Houston, and J. L. Sale, of Dallas, the president and secretary being added to act in an advisory capacity.

Austin was selected as the place for the next meeting, which will take place on the third Wednesday in March, 1897.

The convention then adjourned. After adjournment the delegates and other attendants were driven around the city, under the charge of Mr. J. K. Urie, of the Galveston City Railway Company, and afterward attended an oyster roast at Woollam's Lake.

Trolley Legislation in New Jersey.

One result of the work of the Legislature just closed is the addition to the statutes of five laws of importance relating to electric railways. They were drawn by the Association of Traction Companies of New Jersey, which includes every horse and electric railway in the State.

Senate Bill No 115 is intended to prevent the institution of suits for damages against any railway company by lawyers who offer to hunt up the evidence for the injured, and who take most of the money for their services. It is claimed that a number of law firms make a business of sending out detectives immediately after an accident to hunt up evidence, and that they get most of the money recovered and the injured person very little.

Senate Bill No. 116 bears also on the subject of damage suits. It allows the trolley companies, when a suit for personal damages is brought, to apply to the court to have a physician appointed to make an examination of the injured person, so that the physician can qualify as an expert. Senate Bill No. 134 limits the time within which action for personal injury can be brought to two years from the time the person is injured.

Senate Bill No. 181 gives the governing body of any municipality the power to grant a franchise by two ordinances instead of one—one granting the right of way, and the other containing a description of the places for poles, etc. Should any change be desired in the latter, the one ordinance can be amended without affecting the franchise of the road. Senate Bill No. 182 validates all franchises of trolley roads now established which might be invalidated by mere technical defects in the placing of poles or some similar cause.

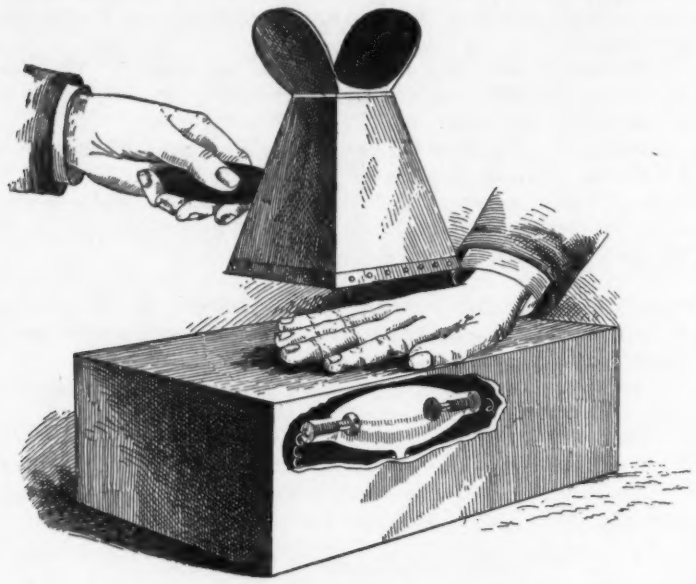
The bill prohibiting trolley roads from carrying freight passed both houses and is in the hands of the Governor. It was amended in the Senate so as not to apply to roads already carrying freight.

Franklin's Will Probated in Boston.

The will of Benjamin Franklin was, on March 26, allowed in the Suffolk Probate Court, Boston, as a foreign will, having been probated about a century ago in the Orphans' Court, Philadelphia. The probate of the will in Boston was deemed necessary in view of the legal disposition of the Franklin fund, which amounts to several hundred thousand dollars, and which was created by Franklin's will. The will was drawn up on July 17, 1788.

The Edison Fluoroscope.

Mr. Thomas A. Edison, who has recently been experimenting extensively with the Röntgen fluorographic screen; has finally devised a practical apparatus for its application, intended more particularly for the use of surgeons and physicians. The construction of the instrument, which has been named the fluoroscope, is very simple. It consists of a tube about eight inches long, larger at one end than at the other. The smaller end is so arranged as to fit snugly about the forehead and eyes. The larger end is covered by a piece of cardboard, on the inner side of which is a piece of white cloth coated with tungstate of calcium crystals. A handle placed on one side enables the observer to hold the instrument. The accompanying illustration shows clearly the position of the apparatus, as is arranged in the Edison laboratory. The vacuum tube is placed in a



Edison Fluoroscopic Apparatus.

wooden box about eight inches square, and one and one-half feet in length. The hand or object that is to be examined is laid directly upon the box over the tube, and the observer puts the fluoroscope to his eyes and looks down. If Röntgen rays are being emitted from the tube, the tungstate crystals fluoresce and the observer can plainly see the shadow of, for example, the hand, the bones and joints becoming quite clearly and distinctly outlined. If the hand is moved, the action is perfectly visible, while if a coin or piece of metal is placed on the box, this is clearly shadowed upon the screen.

The chief trouble that Mr. Edison has encountered, both in these experiments and in his previous ones, in making Röntgen pictures, has been in maintaining permanently a proper vacuum in the tube. After the apparatus has been in operation for a time varying from three hours upward, the action of the tube gives evidence of an increased vacuum, and the Röntgen effect is diminished. To obviate this hindrance to the proper and continuous running of the instrument, Mr. Edison, in the apparatus which he proposes for the medical use will include a mercurial pump; the tubes will not be sealed over, and by means of the pump this vacuum can be regulated at any time.

Reflection of Röntgen Rays.

Prof. Ogden N. Rood, of Columbia University, New York, in *Science* of March 27, gives an account of some experiments made on the reflection of Röntgen rays from platinum, which showed that a small percentage of these rays are reflected from a platinum surface placed at an angle. The reflecting surface consisted of a thin sheet of ordinary platinum foil, held rather loosely against a plate of glass, no attempt being made to remove its accidental deformations, which were mainly parallel. The plate-holder, in addition to its draw slide, was completely covered by a plate of aluminum, .17 mm thick The central horizontal portion of this was again covered by a broad strip of aluminum of the same thickness, and over the holder was fastened a netting of iron wire, destined to furnish the image. The plate-holder being arranged as above described, care was taken that rectilinear emanations from the discharge tube should not even reach the external wooden portions of its frame. After an exposure of about 10 hours, it was found that a good image had been produced on the vertical strip of the plate exposed to the reflected rays. The image had various deformations, corresponding to the platinum foil, the vertical lines representing the netting being as a general thing most distinct; in some places, however, the horizontal lines had the upper hand, and there were some spots where both were equally distinct. The image along those portions protected by two thicknesses of aluminum was perhaps a trifle fainter than that on the rest of the plates. These facts, and the character of the deformations, Prof. Rood thinks, point to the conclusion that in the act of reflection from a metallic surface, the Röntgen rays behave like ordinary light. Some experiments were made to ascertain the percentage of the rays deflected, and the conclusion was reached that platinum foil reflects 1-260 part of Röntgen rays incident on it at an angle of 45 degrees.

Prof. E. B. Frost, of Dartmouth College, in the same journal gives an account of some experiments on the reflection of Röntgen rays. Nickel and copper discs were attached to the under side of a film, and after exposure the effect of reflection was shown by the greater intensity of the dark (or negative) circles above them. Certain plates gave anomalous results of reflection. On four plates an appearance strikingly like interference fringes were observed, which Prof. Frost believes can only be accounted for on the supposition of reflection from a brass spring which pressed against the slide in the holder, thus keeping the plate in place. It was proved that the fringe was due to the spring by placing another Crookes tube behind the plate, thus projecting a shadow of the spring itself upon the plate, upon which at the same time the spring was reflecting the fringe. In one experiment a silver dollar lay on the slide above the plate directly over the spring (which was behind the plate); that the Röntgen rays have been reflected by the spring was shown by the presence of a fringe. Since the central bright line was much brighter than the other portion of the plate partially screened by the dollar, it would seem that this additional brightness could only result from the superposition of waves in the same phase, or, in other words, from something closely akin to interference. Similar fringes were obtained through tinfoil instead of silver, and also where no obstacle intervened between the tube and the film. Prof. Frost hopes by this method to obtain the wave-lengths of Röntgen rays.

It is reported that of the 72 chemical substances which Edison has found to fluoresce when acted upon by Röntgen rays, tungstate of calcium proves to be the best for the purposes of the fluoroscope, tungstate of strontium second; salicylate of ammonia third, and barium-platino-cyanide fourth. The tungstate of calcium crystals, ground to the coarseness of fine sand, are sprinkled over a thin pine board previously painted with collodion. The board is then made to form the bottom of the fluoroscope, the crystal surface being within. Edison attributes the action of Röntgen rays on the sensitive photographic plate as due to the fluorescence of the silver salts.

As we go to press we are informed that Dr. Pupin has succeeded in radiographing the ribs of a human body at a distance of five feet from the vacuum tube. He has succeeded also in obtaining good radiographs at a distance of 25 feet.

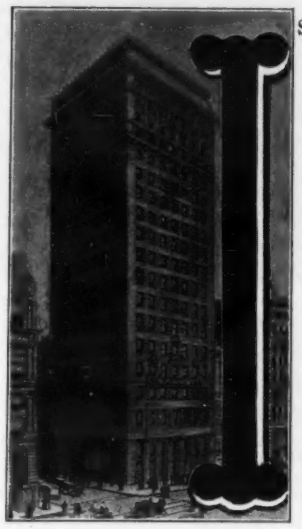
Oscillatory Currents.

Mr. C. P. Steinmetz in an article in the March-April number of the *Physical Review* gives in his "Theory of Oscillating Currents" the following examples:

Very high frequency discharge: A short straight conductor may be terminated by two balls. The balls represent the capacity, while the conductor represents the resistance and the inductance. Without entering into the exact calculation let the resistance of the conductor be $r = .0001$ ohm; the inductance $L = .00025$ millihenry; the capacity of the two balls $K = 10^{-6}$ microfarads. He finds that these numerical quantities introduced in his equations give 320,000,000 cycles per second, and that after .023 second the oscillation has practically died out; that is, decreased to $\frac{1}{100}$ of its amplitude after making 7,400,000 complete oscillations. Twenty amperes flow for a moment at an initial of 10,000 volts, representing an instantaneous flow of 100 kilowatts. To make the discharge non-oscillatory the resistance would have to be greater than 1000 ohms or 10,000,000 times as much as assumed.

For a Transatlantic cable: Assuming $r = 40{,}000$, $L = 30\ h$; $K = 1300$ microfarads; we then have $r < 300$, the condition under which electrical oscillations can take place. If the resistance were $\frac{1}{133}$ of what it is in reality, the oscillations would take place extremely slowly, each complete oscillation occupying more than one second.

The Electric Lighting Plant in the American Surety Building.



ISOLATED lighting plants often have specially distinctive features, and to this rule the plant of the American Surety Building, situated at 100 Broadway, New York City, is no exception. Good apparatus and intelligent engineering arrangement prevail, in this instance, and a description of the plant will therefore prove interesting to ELECTRICAL WORLD readers.

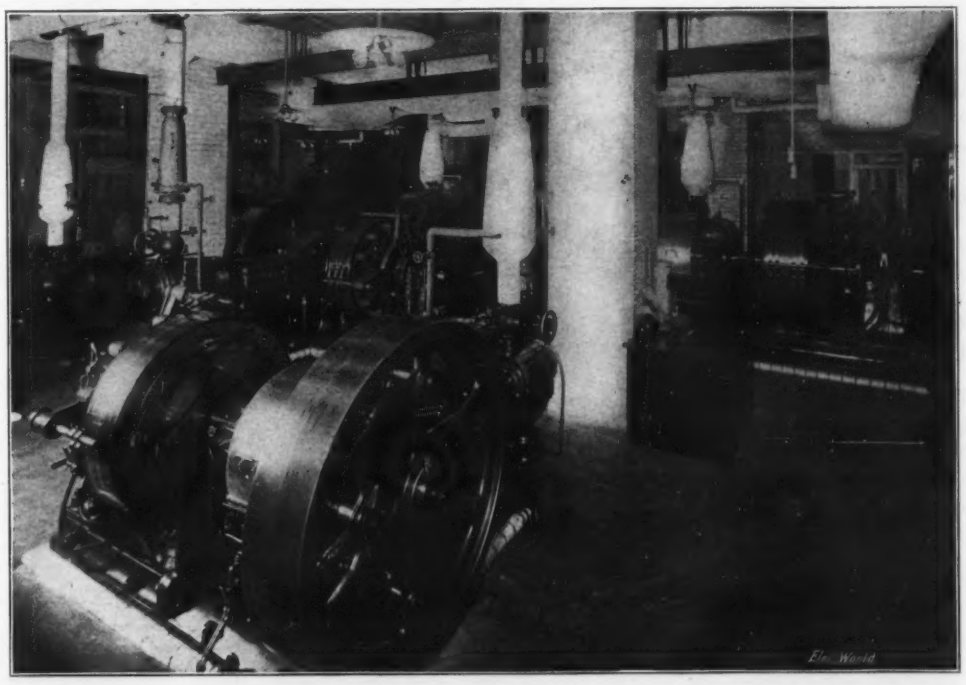
The power is primarily generated in two Babcock & Wilcox water-tube boilers. These stand facing each other directly under the Broadway sidewalk, and are rated at 250 horse-power each. They consume an average of five and one-half tons of coal daily at the present load, the coal and ashes being carefully measured and noted. Two automatic counters on the wall of the boiler room serve as convenient registers for the loads of coal and the cans of ashes. The plant has hardly been in operation long enough to systematize a method of management, but evidence is everywhere indicative of the ultimate predominance of methods both adequate and precise.

The steam, generated at 90 pounds pressure, enters a system of well-covered steam piping, and, passing through a De Rycke separator, enters the engine. It afterward exhausts into a Berryman heater, and the waste product is used in heating the building. In the coldest weather this produces but four pounds back pressure on the engines.

The chandelier and side bracket arrangement is followed in lighting the rooms. In the corridors, however, the lighting is somewhat more elaborate. The upper corridor is fitted with handsome chandeliers, while the lower one is lighted entirely by diffused light. Incandescent lamps are placed near the ceiling and throw the light thereon, whence it is reflected down into the body of the hall. Throughout the building the circuits are controlled by Cutter flush switches.

There are five generating sets, consisting of Harrisburg Ideal engines direct-connected to Siemens & Halske generators.

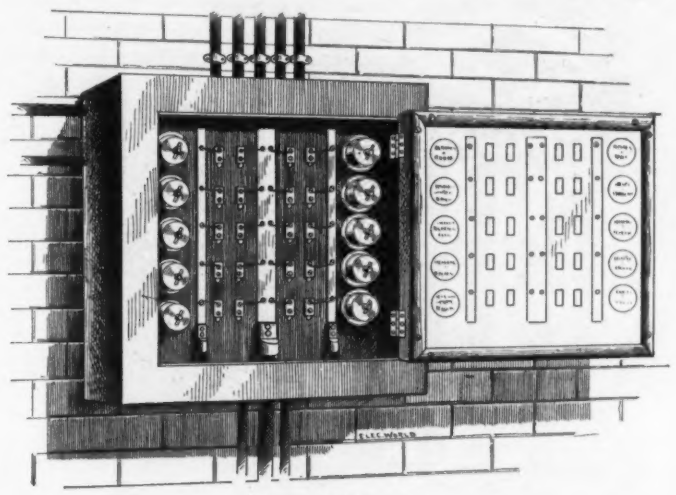
The engines were supplied by W. R. Fleming & Co. The



ENGINE ROOM.

Ideal engine is self-lubricating, with inclosed crank case, the crank dipping in oil at every stroke. Safety diaphragms protect the cylinder in case of water passing over from the separator. Among the other features of the engine is its piston valve with adjustable packing rings to take up wear, the exceptionally large crank pin, the readily removable wrist pin, the sectional packing rings for the piston, and the universal valve stem connection. The interior of the crank case is readily accessible by the removal of a single plate. Two handles suffice to secure this plate in position, and its removal is the work of a moment. The engines are piped for indicators.

The Siemens & Halske generators are all four-pole machines and



SWITCH CABINET.

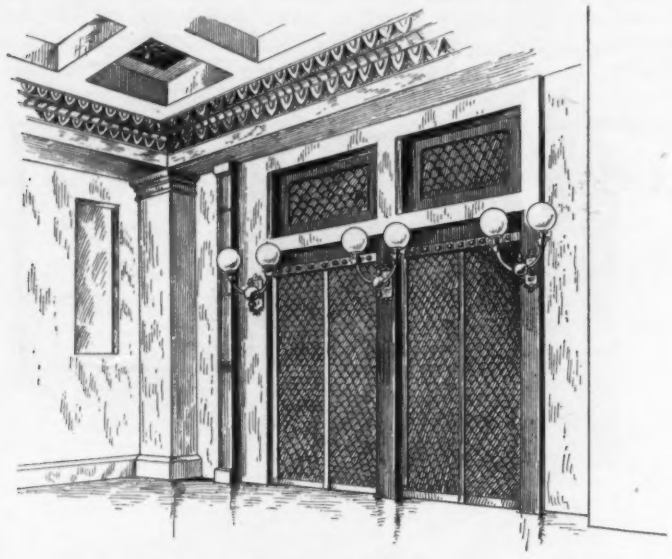
have one outboard bearing. The commutator constitutes the outer surface of the ring armature, and when the bars have become finally settled in place, the machine runs noiselessly and without sparking. It is a theoretical requirement that in order to secure sparkless running the number of commutator bars should be a maximum. In this respect the Siemens & Halske machine has reached practical perfection. Another advantageous mechanical feature of this machine is its extremely short magnetic circuit, and the tendency of the magnets to counteract rather than assist the centrifugal force of the moving armature.

The brushes of the machine are mounted on a rocker which is controlled in angular position by a handle, and secured by a suitable clamping device. The brushes are made to work simultaneously by means of a combination of levers operated by a second handle. This mechanism turns the rocker-studs, and thus simultaneously lets the brushes down upon the commutator or removes them. The brush-clamps are mounted on springs after the original Siemens & Halske pattern, a method which has been widely copied. The brushes themselves are of wire gauze.

The generating sets cannot be over-commended for quiet running. Much has been claimed for other machines, but there is usually some little sound that the listening ear can detect. The only suggestive sound on these sets is the churning of the air by the moving parts, and close proximity and strict attention is necessary to satisfy one's self that there is a sound even from this source. With the absence of sound is necessarily an absence of all vibration. The engineers are very solicitous about the working of their machines, and are striving hard to improve their present operation, which would be the envy of many central stations.

As before stated there are five sets. The two large ones and the two small ones are respectively counterparts of each other, while the odd set is between the two in capacity. The station unit is 25 kilowatts. The next size is 75 kilowatts, while the two large sets are capable of delivering 150 kilowatts each. The dimensions of the engines are as follows: The largest set runs at 230 revolutions per minute, and has a 16-inch cylinder, the stroke also being 16 inches. The intermediate set runs at 280 revolutions per minute, and the dimensions of its cylinder are 12 x 13 inches. The small set has 10

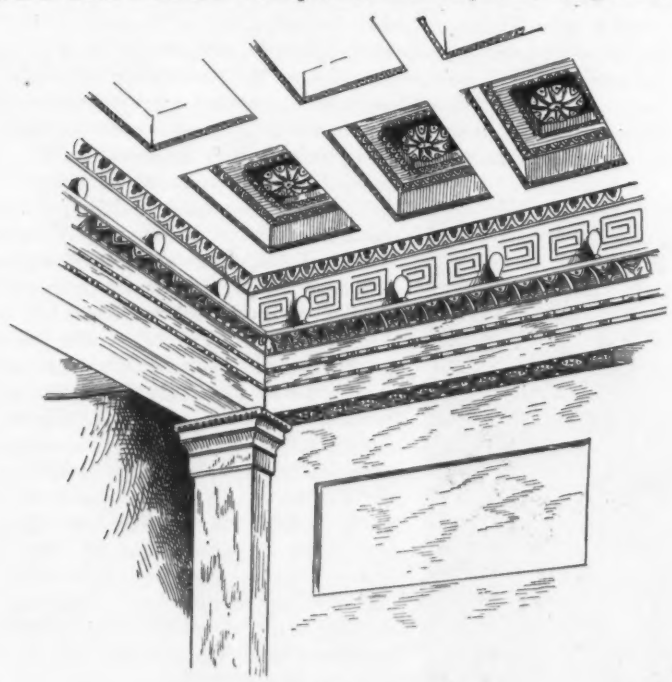
x 11-inch cylinders and runs at 300 revolutions per minute. The respective horse-powers of the three sizes of engines are rated at 150, 75 and 35. The dynamos are compound wound and deliver their current to the bus-bars at 115 volts. They run in multiple, and in consequence have equalizer connections. These connections go to a common bar, an equalizer switch being provided on the machine.



Elevator Lights.

The main fuses of the machine are inclosed in a ventilated metal cage, and are otherwise radically different from common practice. The sets are beautifully mounted on enameled brick foundations with rounded edges. Enameled brick figures conspicuously in the engine room, and forms a sheathing for the massive pillars which support the 23 stories above them.

The switchboard is one of the most attractive features of the plant. It is of white marble, and comprises four main panels, two generator



Cornice Lights.

panels, one circuit panel and one panel for telephone connections. As the equalizer switch of the dynamos is on the machines themselves, the generator switches are two pole. Every machine has an ammeter and a voltmeter, and two summation ammeters measure the combined output of their respective generator panels. A ground detector and two galvanometers are provided with appropriate switches for their use.

The rheostats are back of the switchboard, while the controlling wheels are in convenient positions in front.

All the measuring and testing instruments were supplied by the Weston Electrical Instrument Company, of Newark, N. J. Of these all but two are of the illuminated-dial type, and their symmetrical arrangement on the switchboard gives the latter a fine appearance. In addition to the indicating instruments a Bristol recording voltmeter gives a record of the electrical pressure.

The entire building is wired on the three-wire system with the neutral twice the size of the other mains. Every circuit switch, of which there are 12, is three-pole, double-throw, and therefore can be thrown on to the Edison mains. The coupling of the outer wires together on the station circuits transforms the system into a two-wire system. Iron-armored conduit construction is used exclusively. The cabinet system is used, and appropriate hardwood cabinets fit into the wall at suitable intervals.

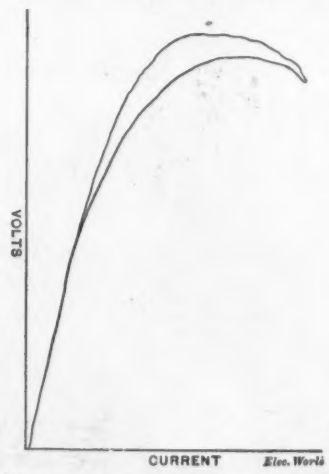
The building is wired for 5000 lights, and at full load a drop of 2 per cent. is expected. The present day load is but 400 amperes, but when all the offices are let it will be much more. At the present load it is impossible to detect any drop with ordinary instruments. The working voltage is 115.

The plant was designed and executed by Messrs. Hatzel & Buehler, of 114 Fifth Avenue, New York, and the good judgment displayed in the engineering arrangement deserves great credit.

A Reason for the Failure of Electromagnetic Regulators.

Both arc and incandescent machines are often regulated in potential by electromagnetic devices which vary the field strength, and it is often found that after having been carefully adjusted they will refuse to regulate properly after a few hours under adjustments that at first were most successful. This is often attributed to the differences in temperature of the machine, and this would be a most sufficient reason if the difficulty did not continue after a constant temperature had been attained. When the current or potential of a machine has a certain value, the electromagnetic device will make a certain adjustment of the exciting current, and this adjustment may or may not be right, even though the output conditions and the temperature of the machine be exactly the same as that of a few hours before, when the adjustment exactly corrected the value of the current or voltage.

The reason for this is found in the hysteresis of the field magnets. As the load comes on in either arc or incandescent machines the field strength rises, and the magnets at a certain output require a certain magnetizing power. On descending the load curve the magnets give a denser flux with the same value of exciting current, and hence an entirely different set of field adjustments are needed. No automatic regulator which depends upon the output of the machine can accomplish this. The point is well illustrated by the characteristic curve of a machine. If the curve of a series machine be taken up to the current capacity of the machine, and then a descending set of readings made, a curve similar to Fig. 2 will result. Being a

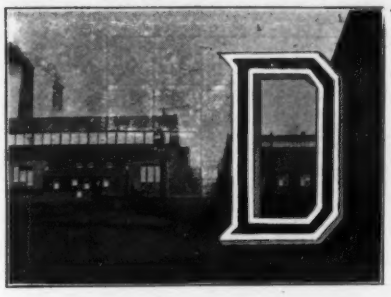


Curves Showing Hysteresis.

series machine, the difference in voltages that may exist with the same field current can be readily appreciated.

There are not a few designers who ascribe to slight temperature changes the failure of their compound machines to regulate exactly, but the many cases where the voltage of a compound machine remains *higher* than it should on descending load cannot be so explained. Therefore, in testing machines, particularly those having magnet cores of a new grade of iron, it is important to take both ascending and descending characteristics. The divergence of the two curves will afford information as to the inaccuracy of regulation that hysteresis will incur and it will often be found to be a factor of sufficient moment to notably influence the choice of iron for field-magnet purposes.

Notes on General Electric Alternating-Current Machinery.—I.



DURING the earlier days of the electrical industry, and even in spite of the fact that systems were then almost monthly placed upon the market, the electrical reading public were kept fully informed of every development in design and practice relating to electrical machinery. The slightest change would be the occasion of rushing into print and hyperbole, and almost every notable advance give rise to a new system. As engineering began to succeed empiricism, and the designing department with its electrical engineering staff took up the functions formerly monopolized by the inventor, a new condition was created. Changes that in former days would have been considered radical, began to be accepted as a matter of course by those concerned in their production, if made in a natural order of development. Thus it happens that often at the present day practically new types are gradually evolved or striking

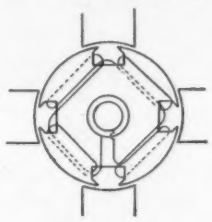


FIG. 1.

improvements are made, of which the general public remain uninformed.

In consequence of the situation thus brought about, and with a view to bringing our readers up to date, some months ago we printed several articles on the latest types of alternating machinery of one of our largest electrical manufacturing companies, and with this we resume the subject, the apparatus of the General Electric Company furnishing the text in this instance. Through the kindness of the officials of that company, every facility for obtaining information was placed at our disposal during a recent visit to the Schenectady works, and the notes thus obtained, though in some respects necessarily restricted by circumstances, will, we believe, prove of some interest to our readers. In the course of the articles incidental attention will also be paid to several subjects having a practical bearing aside from apparatus, such as the calculation of multi-

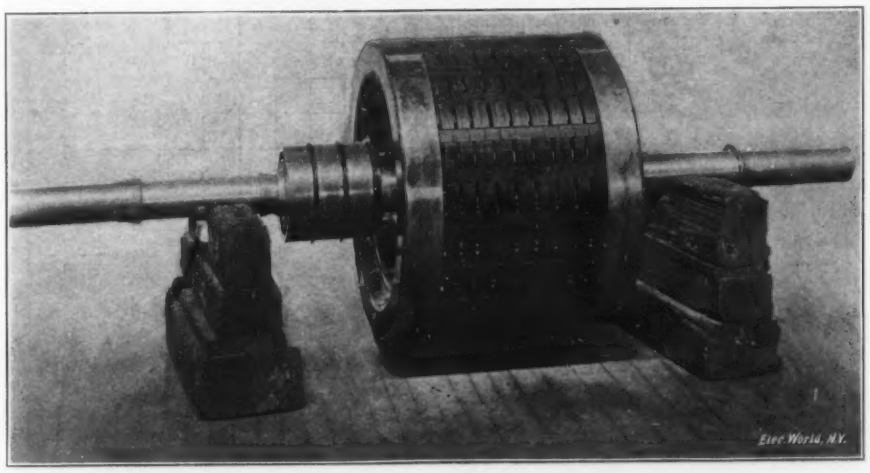


FIG. 2.—ARMATURE OF "A. T." MACHINE.

phased transmission lines, unbalancing in polyphased transmission, etc.

GENERATORS AND SYNCHRONOUS MOTORS.

Since all alternating-current generators can be used as synchronous motors, the two different classes of machines will be considered at the same time.

General Electric Simple Alternators.—These generators have been on the market for such a long period, and are so well known as to make it unnecessary to go into a detailed explanation of their construction or behavior. It might suffice to state that, being designed for 125 cycles, they are unsuitable for long-distance power distribution; since, however, transformers designed for higher frequencies are cheaper than those for lower frequencies, these generators have a wide field of utilization for lighting, and for limited power transmissions. Being simple alternators, they are not self-starting when used as synchronous motors, but run very satisfactorily after being driven up to speed with external power.

The method of winding these generators is as shown in Fig. 1, each slot having two coils connected so as to give opposite polarity.

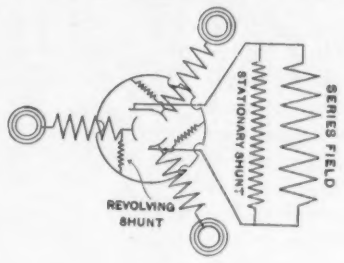


FIG. 3.

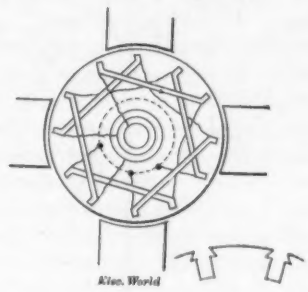


FIG. 4.

Three-Phase Machines.—Generators of this class are made in several types. That known as "A. T." comprises machines of unitooth construction, or having one slot per pole and phase, and having a moderately high armature reaction, and consequently great safety in case of short circuits. These machines are designed for any periodicity, but since the General Electric Company has adopted 60 cycles, or periods per second, as its standard, by far the greater part of them are designed for this frequency. They are built in capacities from 50 kilowatts up to 1200 kilowatts. An armature of one of these machines is shown in Fig. 2.

This type, which is at present in considerable use throughout the country, is particularly applicable in places where power is distributed at moderately long distances, say 5 to 10 miles; owing, however, to the wave shape of these generators which is of the saw-tooth type, they are not well suited for very long-distance transmissions. Up to 300 kilowatts they are usually built with a rectifying commutator for automatically compounding. The compounding is about 12 per cent. at full non-inductive load.

The accompanying diagram, Fig. 3, shows the method of connecting these machines. The armature has a Y-winding; that is, the three single-phase windings, which are displaced 120° or one third of the distance between two poles, are connected to one common junction, which in this case is the commutator, and the other three sides are brought to the collector rings. The common connection is shunted by an external stationary, and internal revolving shunt, as indicated in the diagram. The object of these shunts is to give a means of regulating the amount of compounding necessary, part of the main current, 70 to 75 per cent., going through the series-coil and the remainder through the two shunts.

The stationary shunt is made adjustable in order that the compounding may be varied with the different nature of the load. For instance, in the forenoon, when practically all the load consists of motors, a higher compounding is necessary than in the evening, when the lighting load is predominant. Another object which the shunts accomplish is to eliminate sparking at the commutator.

Fig. 4 shows the shape of the armature punchings and the method of winding. As will be seen, the winding is exceedingly simple, consisting of merely three single-phase windings displaced 120°. The coils are made in two different shapes, and are machine-wound so as to make it easy to replace one coil in case it is damaged by any cause. The slots are open, which decreases the self-inductance, and, consequently, the amount of compounding for the same armature reaction. To prevent eddy currents in the pole-pieces, these are made of sheet iron. The yoke is made of cast iron to enable it to respond quickly to the magnetization of the series-field.

Fig. 5 gives the Y-E. M. F. of a standard "A. T." machine at no load, and Fig. 6 the Y-E. M. F. under load. In the no-load curve (Fig. 5) a distinct triple harmonic of 12 per cent. magnitude, and a very distinct fifth harmonic of 23 per cent. magnitude, are present.

In the load curve (Fig. 6), the triple harmonic is about the same as in the first case, it being 17 per cent., but the fifth harmonic is greatly decreased, being only of 8 per cent. magnitude.

The Δ-E. M. Fs.—that is the E. M. Fs. between the main collector rings of the same machine—are shown in Figs. 7 and 8. Fig. 7 gives the shape of the no-load E. M. F., and Fig. 8 the shape of the E. M. F. under load. Both curves can easily be obtained from Figs. 4 and 5, as each is the sum of two of these waves displaced 60°.

Fig. 9 gives the field characteristic of a standard "A. T." generator. As will be seen, at constant full-load excitation the drop in

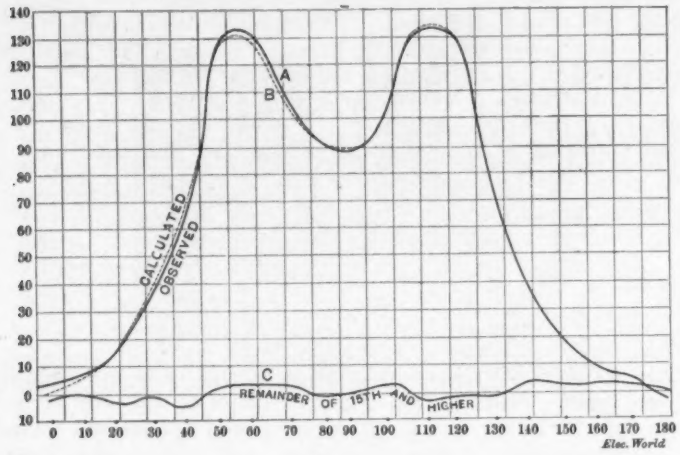


Fig. 5.

voltage at full-load is about 12 per cent. The short-circuiting current is not quite twice the full-load current. The maximum momentary power at short circuit is only 18 per cent. more than full-load power.

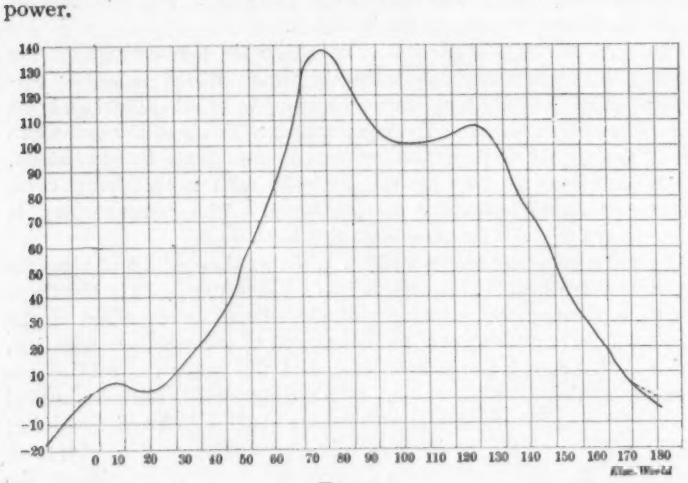


Fig. 6.

A modification of these machines is the "A. F. T." type, having a non-overlapping fractional pitch winding. These machines have a very simple winding, with no crossings whatever, and consequently are of a very suitable construction for high-potential armatures.

For transmission of power to very long distances, the "A. T."

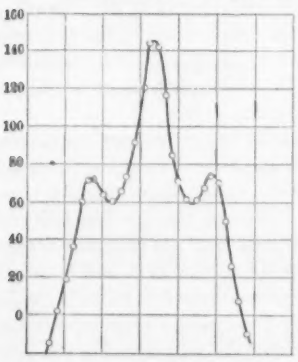


Fig. 7.

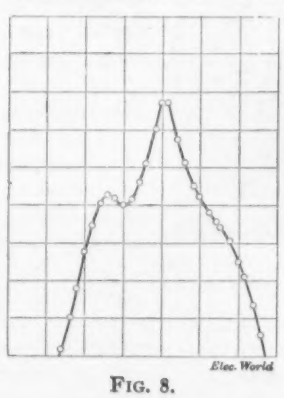


Fig. 8.

machines are not so suitable, as the possibility of resonance is greater with the saw-tooth type of E. M. F. curve than with the sine type. The General Electric Company has therefore designed another line of machinery, known as the "A. P." type, which has a distributed winding, and is of the multi-tooth type of construction. An armature of this type is shown in Fig. 10.

These machines are mostly built for low potentials, say 500 volts,

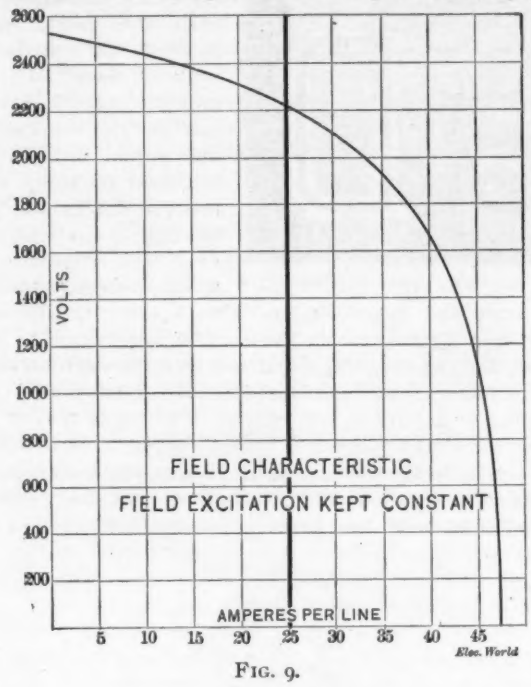


Fig. 9.

as there are a number of crossings in the winding, as may be seen from Fig. 11. They are usually built with two or three slots per pole and phase; that is, the number of slots is usually six to nine times the number of poles. The slots are open, and each has two rectangular conductors. They have a very low armature reaction so as to make it unnecessary to compound them, the total drop at full load being only a very few per cent. They are connected either Δ or Y, depending upon the voltage required, and are gen

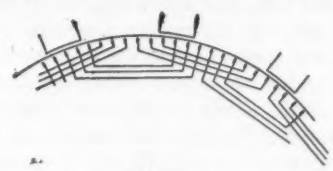


Fig. 11.

erally used in connection with step-up transformers. Two forms of this type are shown in Figs. 12 and 13.

As synchronous motors they are self-starting from rest; in starting

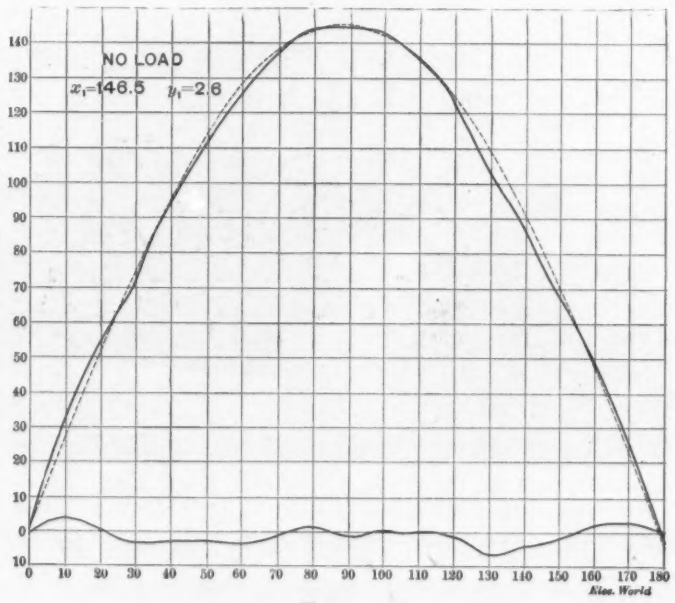


Fig. 14.

they take a current two or three times that at full load, and start with moderate torque.

Figs. 14 and 15 give the form of E. M. F. curves of one of these machines, which, it will be seen, are practically sine-waves—at least

within error of observation, the greatest deviation amounting to only 2 per cent.

The field characteristic of an "A. P." machine of 75-kw capacity is shown in Fig. 16. It will be observed that at full load the drop in

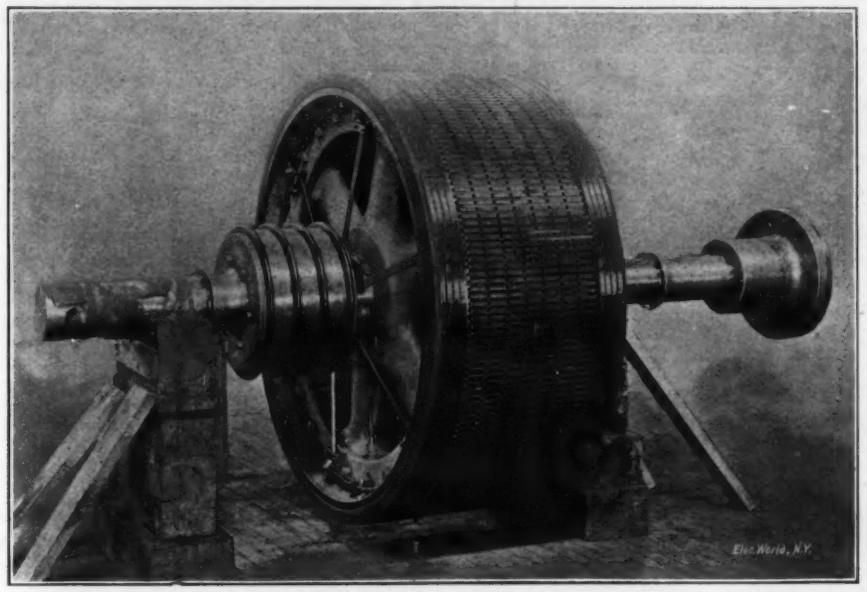


FIG. 10.—ARMATURE OF "A. P." MACHINES.

potential at constant full load field excitation is fully 4 per cent. The current at short circuit is about four times the full load current. The maximum output is about twice the full load power. This class of machines has the advantage of better regulation, and of giving the sine form of wave shape for long-distance transmissions.

Monocyclic Machines.—Three-phase generators are preferably used in places where the power is mostly utilized by motors. For cases where the current is mainly used for lighting, the General Electric Company has devised what it calls the monocyclic system. A greatly unbalanced load on the three branches of the three-phase or other multiphase system will cause the potentials between the different phases to vary. Fig. 17 shows the armature of a monocyclic generator, Fig. 18 the field structure, and Fig. 19 another type of armature.

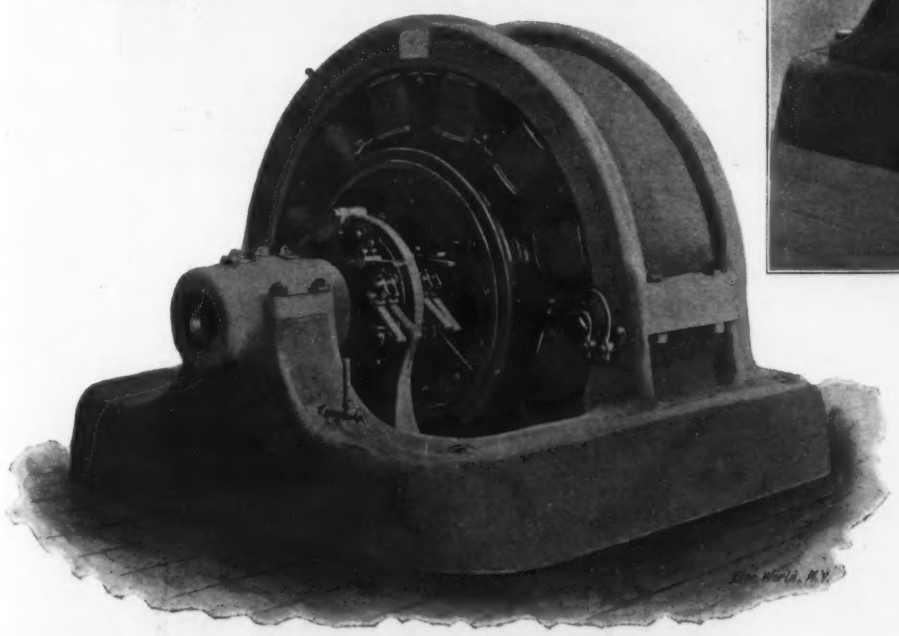


FIG. 12.—12-POLE "A. P." THREE-PHASE GENERATOR.

Monocyclic generators were brought out a year or two ago to solve the question of running motors from single-phase mains, thus enabling compounding to be effected for the total output of the machines.

From Fig. 19 it will be seen that the monocyclic generator is simply a single-phase generator with a slightly different armature, the monocyclic armature having a small winding, called the "teazer" winding, connected midway between the main coils. The object of this teazer winding is to supply an out-of-phase E. M. F. for use in starting and running motors, only. This auxiliary winding creates an E. M. F. displaced 90° from, and of one fourth the magnitude of the main E. M. F., as shown in the diagram. At no load on the generator the value of the voltages between the outside of the teazer winding and the terminals of the main winding is therefore, say, 1040 volts between the two main collector rings, and 580 volts between either of the two mains and the teazer (see Fig. 20). If the main line is loaded, the induced E. M. F. is not in phase with the terminal E. M. F., but displaced a certain angle depending upon the self-inductance; consequently, the triangle of E. M. Fs., when the main line is loaded, is something like what is shown in Fig. 21, where, however, the magnitudes of the phase displacements are exaggerated. If the main voltage is, say, 1040, the voltage between the teazer and one of the mains is 660, and of the other, 480.

The effect of loading the teaser line, that is, of putting induction motors on the monocyclic generator, is to decrease the teaser potential and, on account of the self-induction in the teaser circuit, to shift it; so that the triangle representing the E. M. Fs. at the terminals of the collector rings of the machines when the machine is supplying power as well as light, is something like that shown in Fig. 22. A discussion of the advantage of these changes of the phase relations will be given later when discussing induction

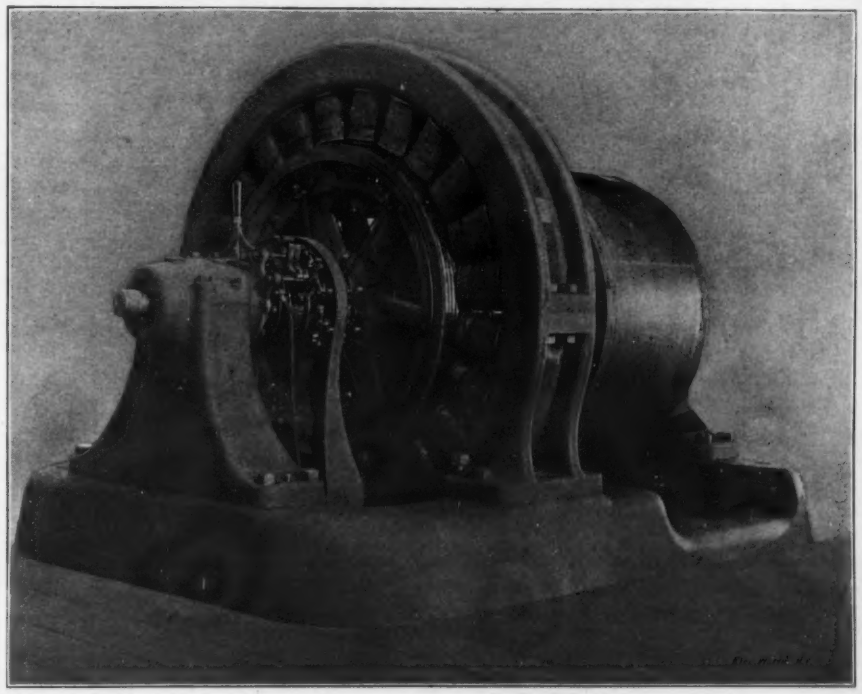


FIG 13.—24-POLE "A. P." THREE-PHASE GENERATOR.

motors operated on the monocyclic system. To run induction motors from a monocyclic generator, the E. M. Fs. generated by the machine are transformed to three other E. M. Fs. of approximately three-phase relation, it being, however, unessential to have the three-phase condition. Two-phase or, in fact, any multiphase condition of E. M. Fs. can be gotten in a similar manner as the three-phase relation. To get three-phase E. M. Fs. two transformers are used. These have the primaries connected in series across the mains, and the secondaries reversed in their relation one to the other. The common terminal of the primaries is connected to the teaser line, and the three secondaries go to the motor terminals. Since the primaries of the two transformers are connected in series and the secondaries in multiple, the currents in two of the secondaries are smaller than in the third. The teaser wire of the primary practically carries only a magnetizing current.

The proper sizes of the main and teaser wire may be approximately determined by the following method: The main lines are calculated as for a regular, simple alternating-current system, taking,

of course, not only the resistance but also the reactance of the line into account. Then the teaser wire is made of such a cross-section

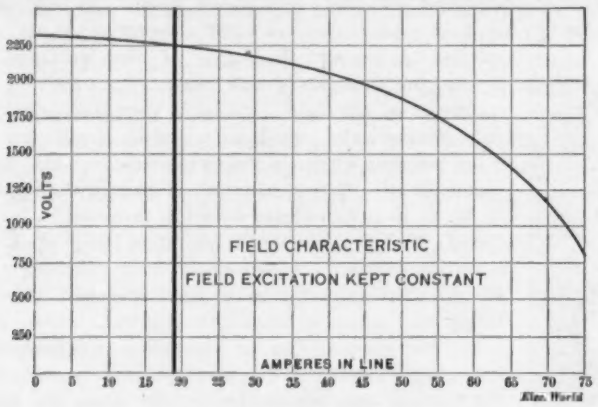


Fig. 16.

that its ratio to the cross-section of the main wire is the same as the ratio of the total motor load to the total load of the machine.

The mains leading to each motor should be calculated as if the entire power of the motor were supplied through them only, and the teaser made of the same size. This method gives a cross-section somewhat too large, but one at least simple to calculate and safe.

For the secondary wiring the total output of the induction motor should be figured as supplied by two single-phase mains with a common return; that is, one wire—that leading from the common

Fig. 21.

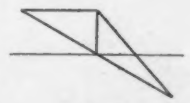


Fig. 22.

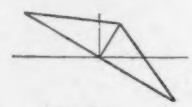


Fig. 23.

connection of the transformers—should be made 50 per cent. larger than either of the other two, and the latter of such a cross-section as to carry jointly the total motor-power as a single-phase current.

All of the above machines—the simple alternators, the three-phase

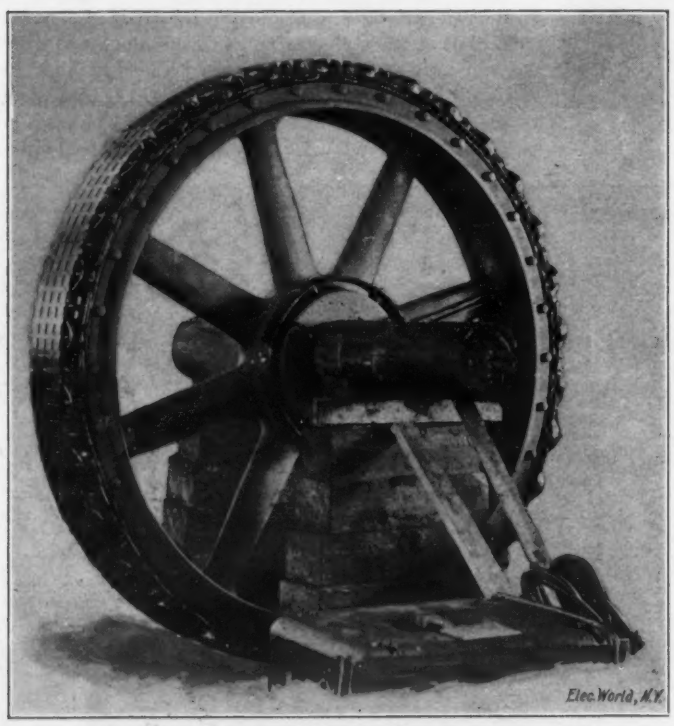


Fig. 17.—Monocyclic Armature.

Fig. 18.—Monocyclic Field Structure.

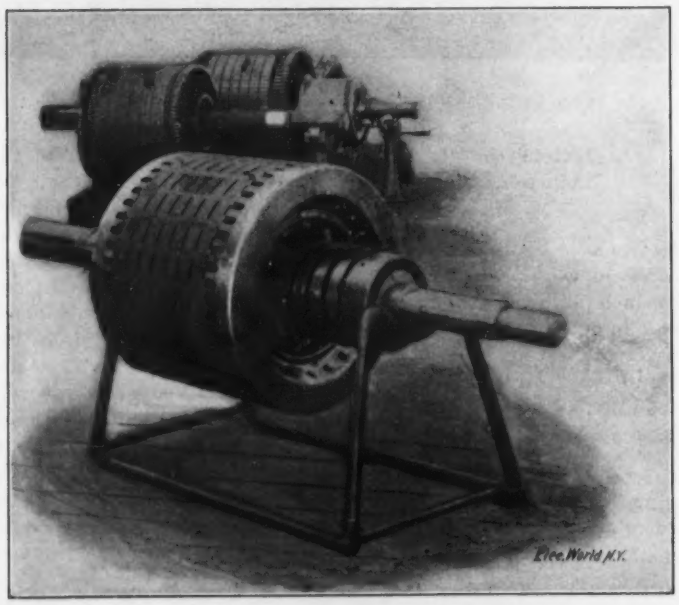


Fig. 19.—Monocyclic Armature.

Fig. 24.—Revolving Field Type.

and the monocyclic machines—are usually built with revolving armature and stationary field. In special cases, as for very high volt-

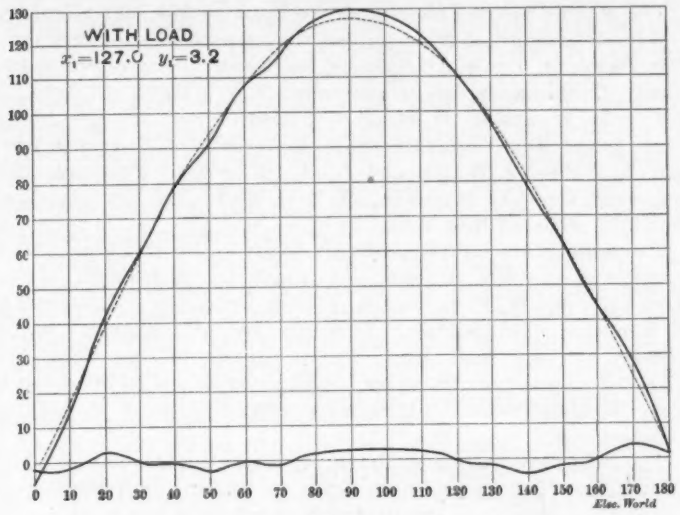


FIG. 15.

ages or very large currents, the machines are built with stationary armature and revolving field. In the latter case the field is inside,

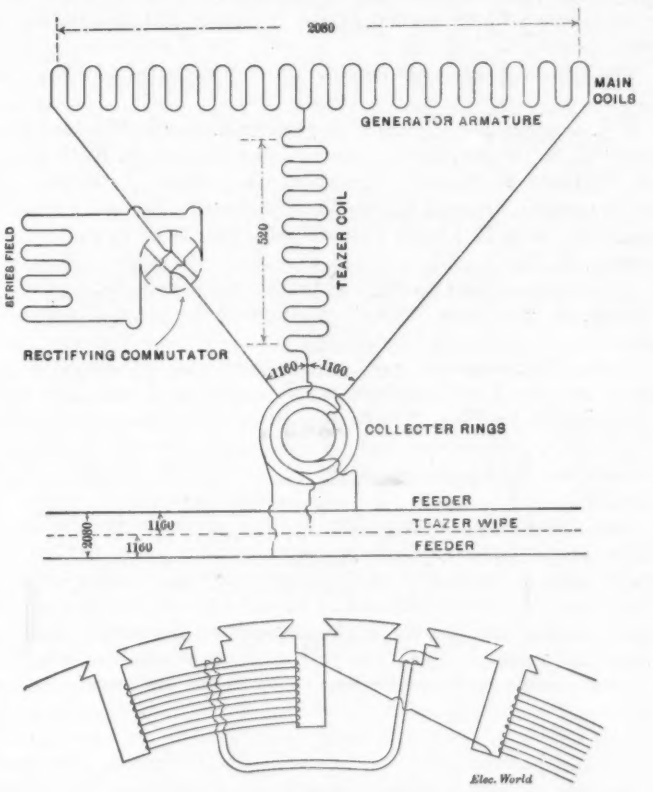


FIG. 20.

the armature outside. Fig. 24 shows a machine of the revolving field type.

Electrographs.

BY WALTER H. MERRILL.

Many persons cannot get access to the apparatus necessary to produce the Röntgen pictures, but there seems to be no reason why an electrograph cannot be made by any one interested. The writer sees no reason why the electricity obtained from a charged driving belt or any similar source cannot produce results just as perfect as in the accompanying illustration, provided the connections are properly made.

The picture, of which a photographic reproduction is printed herewith, was taken by a current obtained from an ordinary Toepler-Holtz generator. Condensers in the form of two small Leyden jars were used, although apparently just as good results were obtained without them. In order that the photographic plate might be watched during the exposure to the current, the pictures were taken in a dark room and the plate left uncovered to view.

At first a coin connected by a rod to the positive pole of the induction machine was placed on the film of the sensitive plate, and this was supported on the bottom of an inverted bottle. Strangely, after a 20 minutes' exposure and development a picture was obtained, not of the coin, but of the bottom of the bottle, all the markings, imperfections and outline being faithfully produced. The position of the coin was marked by a faint circle of light only. During the experiment the plate machine was not allowed to spark or discharge itself. A very pretty brush discharge was obtained at the four corners of the negative, and the whole film was faintly phosphorescent, especially beyond the edge of the bottle.

A plate, when placed on the table and exposed as before, showed not only the outline but some of the markings of the coin. The negative pole when brought near the plate did not improve the action, but a piece of metal placed on the opposite side of the plate did have a decided effect. In this case the coin was placed upon a brass disc kept positively charged from the generator. Upon this, with the film side down, was placed the sensitive plate, and to hold it firmly in place a metal rod was screwed down upon the plate. The shadows cast by the coin and rod appearing on the plate were caused by the light of the plate machine. The intense light under the rod showed that if the whole coin had been covered we might have reduced the time of exposure to at least one half of that used. Accordingly, in the remaining pictures a zinc disc connected with the ground was placed on the back of the plate opposite the coin and the exposure reduced to seven minutes.

On introducing a piece of black paper between the coin and sensitive film, the phosphorescence about the coin and on the film was seen as before, but on the film side only of the black paper. The electrograph has been explained as caused by a glow discharge from the points of the coin. Granting this as the explanation, the glow must be able to shine through the paper with only a very little diminution of its intensity. Another explanation which is suggested by our observation of the glow would be that this light is formed on the film of the plate rather than on the coin. It was found by other negatives that if the coin is removed from the plate only a very short distance (.25 mm) the markings are almost all lost. So in this figure some, if not all, of the loss in clearness of detail is due to the fact

ELECTROGRAPH OF COIN.

that the coin is removed from the plate by the thickness of the paper.

Other experiments prove that it is not necessary to have the coin in metallic connection with the generator. It was separated in the first by two sheets of hard rubber; in the second by hard rubber and a pane of window glass, and in the third by rubber and a piece of quarter-inch plate glass. A streaming off of the discharge in figure obtained in one instance was probably due in part at least, to the very unfavorable atmospheric conditions which existed when taking the picture. For on the following day pictures as good as any taken were obtained under exactly similar conditions, and even when we used three pieces of the plate glass none of the streaming appeared.

From the observations it appears that the photographic plate acts during the exposure as a condenser, and in this capacity it alternately receives from the coin a charge, and returns it back again. The action on the sensitive plate is due entirely to the lights produced when these charges jump from the projections of the coins to the plate, and back again. For when, in place of the coin, a zinc disc is placed tightly on the film so that there will be no jumping of the charge, no light effects are obtained beneath it, showing con-

clusively that the picture is produced by the light rather than by any electrolysis of the silver due to the passage of the current through the film.

The National Electrical Exposition.

As the time approaches for the opening of the National Electrical Exposition, contracts for space are being rapidly closed at the company's office. The 36,000 square feet of space contracted for has already been let, and the management of the Exposition Company have deemed it advisable to contract for an additional 10,000 feet, equally as desirable as the original amount.

The following is a list of exhibitors who have contracted for space:

Abendroth & Root Company, New York.
Adams-Bagnall Electric Company, Cleveland, O.
American Carbon Company, Noblesville, Ind.
American Stoker Company, Dayton, O.
A. A. McCreary, New York.

Babcock & Wilcox Company, New York.
Ball & Wood Company, New York.
Bishop Gutta Percha Company, New York.
Birdsall Electric Manufacturing Company, New York.
Bryant Electric Company, Bridgeport, Conn.
Brady, T. H., New Britain, Conn.
Bradford Belting Company, Cincinnati, O.
Bryan-Marsh Electric Company, New York.
Bossert, Wm. F., New York.
Burry, John, New York.

Carpenter Enamel Rheostat Company, Hoboken, N. J.
Calculagraph Company, New York.
Clark Electric Company, New York.
Columbia Incandescent Lamp Company, St. Louis, Mo.
Corey, R. B., New York.
Chapin-Douglass Electric Company, New York.
Cutter Electrical Manufacturing Company, Philadelphia, Pa.
Crocker-Wheeler Electric Company, New York.
Columbia Rubber Works Company, New York.
Crouse-Tremaine Carbon Company, Fostoria, O.
Crane Company, New York.
Card Electric Motor & Dynamo Company, Cincinnati, O.

Diehl Manufacturing Company, Elizabethport, N. J.
Dale, Farrell & Co., New York.

Eddy Electric Manufacturing Company, Windsor, Conn.
Edison Electric Illuminating Company, New York.
The Electrical World, New York.
Electrical Engineer, New York.
Electricity Newspaper Company, New York.
Electric Storage Battery Company, Philadelphia, Pa.

Forest City Electric Company, Cleveland, O.
Ferracute Machine Company, Bridgeton, N. J.
Fuel Economizer Company, Matteawan, N. Y.

Goubert Mfg. Company, The, New York.
General Electric Company, Schenectady, N. Y.
Gordon-Burnham Company, New York.
General Incandescent Arc Lamp Company, New York.

Harrisburg Foundry & Machine Company, Harrisburg, Pa.
Huebel & Manger, Brooklyn, N. Y.
Holtzer-Cabot Electric Company, Boston, Mass.
Heine Safety Boiler Company, St. Louis, Mo.
Hunt Company, The C. W., New York.

Iron-Clad Rheostat Company, Westfield, N. J.
India Rubber & Gutta Percha Insulating Company, Yonkers, N. Y.

Jewell Belting Company, Hartford, Conn.
Johnston Co., The W. J., New York.

Katzenstein, L., New York.
Keasbey, R. A., New York.
Kennedy Valve Company New York.
Keuffel & Esser, New York.

Lozier, R. T., New York.
Locke Regulating Company, New York.

Mica Insulator Company, New York.
McEwen, J. J., Mfg. Company, Ridgeway, Pa.
National Carbon Company, Cleveland, O.
National Conduit Mfg. Company, New York.
Nowotny Electric Company, Cincinnati, O.
Nuttall, R. D., Company, Allegheny, Pa.
Niles Tool Works, Hamilton, O.
New York & Ohio Company, Warren, O.

Okonite Company, New York.

Phœnix Iron Works, Meadville, Pa.
Peck Electrical Company, New York.
Partrick & Carter Company, Philadelphia, Pa.
Peru Electric Mfg. Company, Peru, Ind.
Payne, B. W., & Sons, Elmira, N. Y.
Proctor-Raymond Company, Buffalo, N. Y.

Reisinger, Hugo, New York.
Riker Electric Motor Company, Brooklyn, N. Y.
Roebling's Sons, Company, John A., New York.
Russell & See, New York.

Stirling Company, The, Chicago, Ill.
Schieren, Chas A., & Co., New York.
Siemens & Halske Electric Company of America, Chicago, Ill.
Sunbeam Incandescent Lamp Company, Chicago, Ill.
Straight Line Engine Company, Syracuse, N. Y.
Standard Electric Lamp & Novelty Company, New York.
Standard Paint Company, New York.
Standard Underground Cable Company, Pittsburg, Pa.
Shultz Belting Company, St. Louis, Mo.
Stanley Electric Mfg Company, Pittsfield, Mass
Safety Insulated Wire & Cable Company, New York.
Stanley & Patterson, New York.
Schoonmaker, A O, New York.
Smeltzer & Company, Nurnberg, Bavaria.

The E. T. Burrowes Company, Portland, Me.
Tucker Electrical Construction Company, New York.

United Electric Improvement Company, Philadelphia, Pa.
United States Mineral Wool Company, New York.

Vacuum Oil Company, New York.
Vetter, J. C., & Co., New York.

Walker Manufacturing Company, Cleveland, O.
Warren, A. K., & Company, New York.
Wagner Electrical Manufacturing Company, St. Louis, Mo.
Weston Engine Company, Painted Post, N. Y.
Weston Electrical Instrument Company, Newark, N. J.
Williamsport Wooden Pipe Company, Williamsport, Pa.
Worthington, Henry R., New York.
Wilkinson Manufacturing Company, Bridgeport, Pa.

In addition to the above the National Exposition Company has another list, nearly as large, of exhibitors who have reserved space, but whose contracts are not yet actually signed.

The American Institute of Electrical Engineers.

The regular monthly meeting of the Institute was held March 25, and the following Council nominees were reported by the secretary: For president, Louis Duncan, of Baltimore; for vice-presidents, Chas. P. Steinmetz, of Schenectady, N. Y.; Harris J. Ryan, of Ithaca, N. Y., and W. M. Stine, of Chicago. For managers, J. W. Lieb, Jr., of New York City; F. A. Pickernell, of New York City; Wm. L. Puffer, of Boston, and L. B. Stillwell, of Pittsburg. For treasurer, Geo. A. Hamilton, of New York City; for secretary, Ralph W. Pope, of New York City.

The terms of the following officers do not expire this year: Vice-presidents, Angus S. Hibbard, of Chicago; Dr. M. I. Pupin, of New York City, and W. F. C. Hasson, of San Francisco. Managers, A. E. Kennelly, of Philadelphia; C. S. Bradley, of Baltimore; W. D. Weaver, of New York City; W. B. Vansize, of New York City; Chas. F. Scott, of Pittsburg; Carl Hering, of Philadelphia; Cary T. Hutchinson, of New York City, and B. J. Arnold, of Chicago.

The rules have been amended by the Council under advice of the Committee of Incorporation, in order to conform with the laws of the State of New York, this having been rendered necessary by the recent incorporation of the Institute. The rules will hereafter be known as the "Constitution," and under its provisions the secretary is now elected by the Institute at large, instead of the Council. The system of cumulative voting is abolished. Copies of the revised constitution will be mailed to the members with the ballots on or before April 15.

The following associate members were transferred to full membership:

F. J. Dommerque, Chicago, Ill.; Harry E. Heath, Windsor, Conn.; Prof. M. T. O'Dea, Notre Dame, Ind.; Francis B. Badt, Chicago, Ill.; Willard E. Bouleau, Columbus, Ga.; Elmer E. Boyer, Lynn, Mass.; James Mitchell, Rio de Janeiro, Brazil; Maurice Coster, Chicago, Ill.; John E. Lloyd, Philadelphia, Pa.; Wm. B. Potter, Schenectady, N. Y.

The paper of the evening was presented by Prof. W. L. Puffer, of Boston, on "A New Method of Studying the Light of Alternating Arcs."

Owing to the necessity of having direct, single-phase and three-phase currents for the experiments, it was deemed best, after reading the paper at 12 West Thirty-first Street, to adjourn to Columbia University, where the use of the apparatus of the Electrical School was kindly placed at the disposal of the Institute by Prof. Crocker.

The following is a summary of the paper as presented: Prof. Puffer employed the stroboscopic method for analyzing the alternating-current arc, a method which has been quite extensively used in other lines of physical investigation. In order to examine any particular part of the current wave passing across the arc, a small synchronous motor is used carrying a brass disc about one foot in diameter and provided with four radial slots. This motor is brought up to any desired speed by a second motor, and when the disc is nearly in synchronism with the current wave of the arc the alternating polarity of the carbons can be viewed as though they changed but every few seconds instead of 260 times per second; the number of half periods per second of the alternator. In this way it may be shown that the alternating arc has all of the characteristics of the direct-current arc. The hot positive carbon with its white hot crater, from which extends the fan-shaped blue light of the arc to the small white tip of the colder negative carbon, will be seen to die away, and all light goes out except the glow of the red-hot carbons, and then light appears again with the current reversed.

Prof. Puffer finds that with 500 volts and a large non-inductive resistance in series with the arc, that the current wave is practically sinusoidal, since the time of extinction of the current, as indicated by the blue band of the arc proper, is very short, and the rise and fall of the current gradual, with no irregularities. This he says is to be expected, as the back E. M F. of the arc is small compared to the voltage of the generator, and the circuit as a whole is non-inductive.

The opposite condition is realized by using a lower E. M. F. and regulating by a reactive coil. The time of no current is longer, and the current appears to jump to its maximum in an exceedingly short interval of time. In this case the arc is not steady, showing clearly to the eye that the succeeding waves of current are not alike in form or current value, and also that the angle of lag is constantly changing. This fact has always prevented an accurate plotting of wave

forms by the instantaneous contact method, and although known to exist, was never before actually seen.

By means of a switch the non-synchronous motor is cut out, and the synchronous cut into circuit, when the armature drops into step with the dynamo, and the arc is instantly seen as fixed. The synchronous motor does not stand on its base, but rests on the turned outside of its bearings in pillow blocks which are attacked to a suitable base frame.

Concentric with the shaft and firmly attached to the motor is a brass gear, 6 inches in diameter, and on it a graduated circle. On a lever pivoted so as to be thrown to or from the motor gear is a small spur gear with a milled head for turning.

Turning this head will evidently cause the motor to slowly rotate about its axle, and as the armature must be in step with the dynamo, and as the turning of the motor changes the position of a given pole-piece relatively to the arc light, it follows that any part of the alternation of current in the arc may be seen on the screen, and as the motor has eight poles, a quarter turn or 90° on the graduated circle, corresponds to a complete cycle in the arc.

The picture of the arc can then be photographed, measured, or in any way studied at leisure in any phase relation, as, for example, when the top carbon is positive, or when there is no arc at all and only dull red carbon points visible.

One of the most beautiful arcs shown was a rotary arc made by the use of three carbons in the same plane, at angles of 120° apart and wired up as the junction point of an external Y load on a 500-volt 60-cycle three-phase generator. Non-inductive resistance was used in the circuit, and the current used in one leg of the Y was 10 or 15 amperes.

This three-phase arc, when seen while the disc is running non-synchronously, is the most beautiful of any studied, and may be seen according to the different length of arc and the divergence of the disc from exact synchronism, either as a band of blue light which seems to be progressively travelling over the three sides of a triangular path, or as a rapidly spinning star of blue light, being in fact a rotary arc.

The three-phase arc is less noisy than the single-phase, and its light is steadier and has less vibration in its total intensity, owing to the fact that the current never stops, and there is always a positive carbon. Three cored carbons, placed parallel side by side, with slight magnetizing coils to keep the arc at the ends of the carbon, will give a very satisfactory light in the direction away from the tips, and may be used when it is desirable to throw the light all in one direction.

Four carbons at 90° apart, each with a suitable resistance in series with it, and connected to quarter-phase tap wires on a Gramme ring or other generator giving quarter-phase circuits, will also produce a rotary field arc of great beauty and interest. Prof. Puffer hopes to produce results sufficiently interesting to justify a second paper at some later date.

The study of these arcs is still going on at the Massachusetts Institute of Technology, and Prof. Puffer expects to be able to present further results of this interesting method of the phenomena taking place in alternating current arcs.

An Interesting Analogy.

In describing the disruptive action of a spark gap in the usual apparatus for producing high-frequency, high-potential currents, Dr. M. I. Pupin in a recently published article states that the circuit in which the oscillating current is produced may be compared to a church bell, the disruptive action at the gap performing the function of the swinging tongue of the bell; after each stroke "a series of waves spreads out into space—melodious sound waves in one case and silent electric waves in the other."

Electricity in China.

The *British Trade Journal* publishes an extract from a recent report by the Belgian Minister at Peking, in which he says: "The electric light is but little known to the Chinese. An enterprising individual in Peking is now making great efforts to obtain a concession for lighting the Imperial Palace with electricity. He has fitted up a small luminous fountain in his shop, which has created great astonishment and admiration among the high officials he has invited to inspect it. A leading Chinese journal, the *Chung Hua Pao*, recently had an article on the advantages of electricity."

Is Tesla to Signal to the Stars?

During the past week a number of the New York dailies contained interviews with Nikola Tesla, which were printed under "scare heads," such as, "May Signal Stars," "We May Signal to Mars." We reprint the following interview from the New York *Sun:*

"I have had this scheme under consideration for five or six years, and I am becoming more convinced every day that it is based upon scientific principles, and is thoroughly practicable. We know that electric disturbances on the sun are productive of similar disturbances on the earth in the form of thunder showers. Now, why is it not equally conceivable that a disturbance on the earth's surface should produce some tangible effect on other planets? The transmission of disturbances on the sun shows beyond doubt that waves of electricity are propagated through all space.

"The objection may be put forward that sufficient electrical disturbance cannot be made on the earth's surface, and that we should be wholly dependent upon thunder storms and other phenomena of nature for the success of our experiment. But, on the contrary, we can make all the artificial thunder and lightning we want. There is no difficulty in making electric apparatus with a spark gap of a mile, and if that did not prove effective it could be increased.

"Do not get the impression," continued Mr. Tesla, "that the success of the experiment is in any way dependent upon the light, noise, or vibration accompanying such an electric discharge. It is wholly through the electricity waves, which are propagated through the atmosphere and the ether beyond, that we may hope to obtain any results. But if there are intelligent inhabitants of Mars or any other planet, it seems to me that we can do something to attract their attention.

"This, of course, is the extreme application of this principle of the propagation of electric waves. The same principle may be employed with good effect for the transmission of news to all parts of the earth. It was formerly thought that in order to get any power out of electricity a conducting circuit must exist, but it has been shown that the same results may be accomplished with a single wire. It is perfectly possible to operate a motor or an electric light with just a single line of wire leading to the apparatus. It naturally occurred to me that, as the earth is a conductor, an electrical disturbance at one point, causing a change in the equilibrium of the earth's electricity, should be felt at all points on the earth's surface, and might be recorded by properly constructed instruments.

"The possibilities of such a transmission of intelligence cannot be exaggerated. Every city on the globe could be on an immense ticker circuit, and a message sent from New York would be in England, Africa and Australia in an instant. What a grand thing it would be in times of war, epidemic, or panic in the money market!"

Mr. Tesla, says the *Sun*, is at present engaged in finishing his calculations and perfecting the apparatus necessary for experiment in his new field of investigation, and he hopes soon to be able to show the practicability of his plan.

The following we abstract from an interview in the New York *Herald:*

"Years ago, in St. Louis, I delivered an address before the National Academy of Sciences. I then declared it would be possible to use economically the electricity in the atmosphere for lighting and heating, and, of course, for communication between different parts of the earth's surface. The problem was the conservation of electrical energy at the least possible cost to the other elements. That problem, I was confident then, I could solve by my oscillator. At present I am sure it can be done. From my most recent experiments I am convinced that within a very short time we shall be independent of the clumsy methods of generating electricity now in vogue. The electrical fluid in the atmosphere will give energy enough. The same electric envelope of the earth will enable us to send messages from one part of the globe to all other parts in an instant of time. The same element, which I believe to be finite and not confined to this atmosphere, may be used to communicate with the other planets."

The oscillator referred to, it may be explained, is a combined steam engine and alternating-current generator, the piston of the engine being direct-connected to the armature or field of the alternator and oscillating to and fro at a rapid rate. It is consequently difficult to see how the reporters should have imagined it to be capable of such startling performances.

Röntgen Ray Nomenclature.

The following suggestions as to the correct name to be applied to Röntgen pictures were received in response, partly to a recent editorial asking for such suggestions, and partly in reply to letters, accompanied by a list of some two-score proposed names, addressed to a number of authorities, requesting an expression of opinion on the subject:

Mr. C. E. Scribner, Western Electric Company, Chicago:

I favor Röntgen pictures as the name to be applied to shadow prints.

Prof. Harris J. Ryan, Cornell University, Ithaca, N. Y.:

I think that I prefer radiograph. It would be hard on Lenard to call these pictures Röntgraphs.

Frederic C. Whitmore, Philadelphia, Pa.:

Referring to your editorial of the 11th inst. regarding a proper name to designate shadow prints produced by Röntgen rays, I would suggest silhougraph as apropos.

Thomas Alva Edison, Orange, N. J.:

As the pictures are due to the absorption of Röntgen rays by the silver salts, and as the same fluoresce with the rays, thereby absorbing energy sufficient to cause decomposition, why not call the result fluorograph? Then with the fluoroscope we see and with the fluorograph we record.

Houston & Kennelly, Philadelphia:

In reply to your favor of the 20th inst., asking our opinion as to the preferable name for the pictures produced photographically by the Röntgen rays, we beg to say that of the 18 names you mention we prefer the terms radiograph and skiagraph. We think that either of these would be suitable and applicable.

Prof. Edwin B. Frost, Dartmouth College, Hanover, N. H.:

In reply to your inquiry as to a name for the pictures taken with the Röntgen rays according to Röntgen's method, I would say that I prefer skotograph, which is correct etymologically, has a fair analogy to photograph, and is about equally adaptable to the English, German, and French languages.

Mr. Nikola Tesla, New York City:

I regret that I am unable to suggest the proper name. It seems to me that your store is large enough to suit almost any requirement. I would have been glad to comply with your request, but my time is so taken up with more important matters that I cannot spare a moment for the purpose of expressing myself through the press.

Prof. Frederick Bedell, Cornell University, Ithaca, N. Y.:

Radiograph is general. A radiograph is a cathodograph if the rays are obtained from a cathode; we may be able to produce them otherwise. Shadowgraph or skotograph is correct for any shadow pictures (might be with sunlight). Some day we may get cathodographs by reflected cathode rays. Then *shadow* or *skoto* would not apply.

Prof. Chas. R. Cross, Massachusetts Institute of Technology, Boston:

For the present I prefer to call the Röntgen shadow-print by that name or X-ray photograph. I am not fond of new names until we find them a necessity. Sciagraph, which I should prefer, has already been used in another sense, and the same is true of skotograph. All the other terms mentioned by you are objectionable for one or another reason, and many of them are barbarous.

Prof. Henry A. Bumstead, Sheffield Scientific School, New Haven, Conn.:

I have given very little thought to the subject of a suitable name for the pictures taken by means of the Röntgen rays, and it seems to me that the question might better be left an open one until more is known about the agent which produces the effect. As time goes on a process of natural selection will probably cause the most appropriate name to be finally adopted. As a matter of language, however, it is to be hoped that such compounds as shadowgraph, X-gram, etc., may not come into general use.

Prof. M. I. Pupin, Columbia University, New York:

With reference to the naming of the process of photographing by means of the Röntgen radiance, I beg to state that I prefer to wait for Prof. Röntgen's complete account before suggesting any definite name. Radiograph sounds well; it is not sufficient to distinguish it from ordinary processes of photography, but it will do. It is a much broader term than photograph, and the fact that it is composed of two words, one borrowed from the Latin and the other from Greek, should not worry us very much.

Dr. Louis Bell, Boston, Mass.:

Until our knowledge of what Röntgen very pertinently called X-rays, is enormously increased, any attempt at a truly descriptive name is eminently silly. I know of no subject of scientific discussion in which the ratio of facts to words has been so pitiful. When some clear idea of the physical nature of the X-rays has been gained, a proper name will at once be evident. For the present, X-ray picture is the least objectionable name in use, as it is sufficiently distinctive, and quite non-committal. Most of the others named in the list you have compiled are sophomoric and barbarous.

Prof. Harold B. Smith, Purdue University, Lafayette, Ind.:

With regard to a desirable name for the pictures secured by the methods of Prof. Röntgen, there is, as indicated in your editorial of March 21, a wide diversity of opinion. In fact, a thoroughly convenient term, which is at once descriptive and exclusive, seems to be wanting. Of the different names suggested, perhaps the earliest, radiograph, may be as satisfactory as any. It is descriptive, convenient, and when coupled with the name of Röntgen, as Röntgen radiograph, is sufficiently definite when the context does not indicate clearly what is intended by the simple word radiograph.

Prof. A. F. McKissick, Alabama Polytechnic Institute, Auburn, Ala.:

In regard to the proper name to be given to the prints produced by Röntgen rays, it seems to me that the name Röntgraph, above all others, should be adopted. While it is not a word that has a good appearance or sound, it nevertheless carries with it the name of the discoverer of these rays, and would for that reason, I believe, be popularly understood and used.

Prof. Daniel W. Hering, University of the City of New York, New York:

Until more is known than at present about the Röntgen rays, I think radiograph is the most suitable name for the picture they produce. It does not declare anything that it is at all likely will have to be "taken back," and the only objection to it, I think, is its indefiniteness. A photograph is also a radiograph, but in the case of the Röntgen pictures, where a distinction is needed, they might be called Röntgen radiograph. A great difficulty is likely to occur in getting a word to express the operation of taking the pictures, and here radiograph would also serve the purpose.

Prof Henry S. Carhart, University of Michigan, Ann Arbor, Mich.:

I incline to the use of the word radiograph to designate the shadow prints taken by means of the Röntgen rays. The radiometer was one of the early instruments of Crookes which led to the most recent and remarkable discoveries in connection with electrical discharges in high vacua. Besides, there seems to be accumulating evidence still in favor of the original view of Crookes that all these remarkable phenomena are due to the projection of the residual gas from the excited pole. These shadow prints are produced by means of something radiated from one or both poles of the tube.

Prof. Samuel Sheldon, Polytechnic Institute, Brooklyn, N. Y.:

I am in favor of the name skiagraph or skotograph to be applied to the shadow prints taken by means of Röntgen rays. My reasons for the preference are that the words truthfully describe the object, the two syllables of each are derived from the same language, and that language being Greek, brings the words into harmony with the nearly related word, photograph. Of the other words suggested, it seems to me that cathodograph, cathodogram and radiograph are premature, scotograph and sciagraph are improperly spelled, shadowgraph and shadogram are philologically weak, and Röntgraph is too non-euphonious to do honor to the great discoverer.

Prof. Henry A. Rowland, Johns Hopkins University, Baltimore, Md.:

As the new photographs have nothing to do with the cathode rays, as we have shown in the laboratory of the Johns Hopkins University, being more nearly related to the anode, all names referring to the cathode should be avoided. Likewise all names referring to other individuals than Röntgen should be rejected. The rays themselves should, according to my view, be simply called Röntgen rays or X-rays, and the photographs by means of these rays should be known as Röntgen photographs, thus keeping the name of the discoverer of this wonderful phenomenon ever before the world, as it deserves to be.

Prof. William Fox, College of the City of New York, New York:

Permit me to call attention to the fact that the words scotograph,

scotoscope, sciagraph, sciagraphy, sciography and skiagraphy are already found in our dictionaries: Thus, quoting from the *Standard Dictionary*: "*Scotograph*—An instrument designed to assist the blind in writing or to facilitate writing in the dark. *Sciagraph* or *sciagraphy*, etc.—The plan (?) of a building in vertical section, showing the interior structure. *Sciagraphy*—(*astr.*) The art of finding the time of day or night by observing shadows caused by the sun, moon, or stars; dialing. (*Art*)—The art of correct shading." Other dictionaries give similar definitions.

Prof. W. LeC. Stevens, Rensselaer Polytechnic Institute, Troy:

Of the names you enumerate, it seems to me that there are only two that ought to receive much consideration, radiograph and cathodograph. My preference is decidedly for the first of these; for cathodograph is not a safe name until it be established that Röntgen rays are identical with cathode rays. It does not at present seem probable that this identity will be established. But even granting it, the word radiograph would still be applicable. It includes photograph within its scope, but the latter has become so differentiated during the last forty years that no misunderstanding would result from including it in the more general term applied to the newly discovered radiation, which brings about chemical effects similar to those of the so-called "actinic" radiation.

Prof. Arthur W. Goodspeed, University of Pennsylvania, Philadelphia:

As I myself suggested radiograph for a name to the new pictures, I should naturally feel gratified if that were adopted. The name was made in our laboratory on Feb. 7, and published a few days later in the *Medical News*. I have heard since that Dr. Lodge also suggested the same term about the same time. This is certainly good endorsement. Röntgraph I deem very appropriate, but the term is not euphonious. I think skiagraph much better than skotograph, since it *is* a shadow effect and not something produced by "darkness." Sciagraph and scotograph are, of course, the same words badly spelled. There seems no reason for changing a *k* to a *c*. Shadowgraph is undignified, and savors too much of newspaper talk. Cathodograph is probably incorrect, as the cathode rays are not the ones that are supposed to produce the effect. The other terms mentioned are obviously inferior to those already given. Radiograph might be objected to for being a hybrid word, but a glance at any Latin lexicon shows that the root *graph* was used in classical Latin, and would, therefore, have been quite intelligible to a Roman. The word is also euphonious.

Prof. C. F. Brackett, Princeton College, Princeton, N. J.:

None of the many names mentioned as having been suggested for the pictures taken by the process of Prof. (Baron) Röntgen seems to me to be well chosen. In our ignorance of what goes on during the process of securing these pictures, a name should be, at least provisionally, adopted which implies no theory respecting the agent to which they are due. The one which seems to me best suited to express accurately the result of the process is skiasmagram. This word, if it should be adopted, will not be open to any objection on the score of derivation. Its exact English equivalent is shadow-picture, and that is exactly what is secured by the process in question. The objection to skiagraph is that means a canopy picture. Or, rather, that is what it might mean if the component *graph* could be supposed to mean the same as *gram*, which it does not. Skotogram is well suited to the case if we wish to emphasize the fact that the picture is taken in *darkness*. But we may take pictures in darkness by the ordinary photographic process (with ultraviolet light).

Prof. Edwin H. Hall, Harvard University, Cambridge, Mass.:

The following considerations should be kept in view in choosing a name for the Röntgen pictures: First: The name should be fairly descriptive of the main feature of the Röntgen effect. Second: It should contain a minimum of theory, as the theory of the whole action is still uncertain. Third: It should be reasonably easy to pronounce, and of such form that a simple addition will give a name for the art of making the pictures. Fourth: If partly Greek, it should be all Greek. It seems to me that skiagraph meets these requirements better than any other name I have seen proposed. Skotograph would be irresistible if the effect were produced by *darkness*, as photographic effects are produced by light, but as this is not the case, the analogy of skotograph to photograph would be rather misleading than helpful. Radiograph is not sufficiently definite. It might apply to an ordinary photograph. The form skiagraph is preferable to sciagraph, because it leaves no doubt as to the pronunciation. It is no objection to this word that *skia* in Greek meant not only a *shadow*, but also a *ghost*.

Prof. Elihu Thomson, Swampscott, Mass.:

Personally I have little preference for one name over another for the Röntgen ray pictures, except that I should decidedly object to any name which takes away from Röntgen the credit of the discovery. If, as I believe, the Röntgen rays come from the anode and not the cathode, any word like cathodograph or cathodogram would be untrue and unsuitable. I am indeed satisfied with the terms, Röntgen pictures and Röntgen rays, for the present or until much more is known of them. If the anode is the source of the rays, then anodograph and anodic rays would express the facts as well as any other terms, and would, moreover, be euphonious. Still, I have no wish to add to the confusion of terms. Indeed, I regret that so many have insisted on naming the child of Prof. Röntgen without consulting the father. Some of the names in your list are too broad, others hard and not euphonious, others again too long, while still others strike me as misrepresenting the facts. The last term you mention is Röntgen pictures, and, I think, is the best of the collection.

Prof. W. F. Magie, Princeton College, Princeton, N. J.:

In response to your letter of inquiry, I would express my decided preference for skiagraph as the proper name for the pictures taken by the Röntgen rays. Σκια means shadow; now, these pictures are shadow pictures, without doubt; the word is already in use, I believe, in architecture, but that would not interfere in the slightest with our use of it. Radiograph, shadowgraph, X-gram, are improperly compounded words from two languages. Röntgraph is hideous. X-ray pictures would do if it were not fair to attach Röntgen's name to the rays in place of the indefinite X his modesty led him to use; scotograph means writing by darkness, which is not what is intended. Cathograph and gram contain a false view of the action. Penetraliogram is absurd; electrograph is too indefinite. Electroskiagraph would be better than skiagraph, perhaps, if it were not unnecessarily long, and if there were danger of confusion. Finally, sciagraph should not be used, because that makes the reader soften the *sc* as if it came from *scio*. Perhaps my view is determined by the fact that I have used skiagraph already in an article in the *American Journal of Medical Science*, March, 1896.

Prof. Arthur W. Wright, Yale University, New Haven, Conn.:

It seem to me yet too early to settle the nomenclature of the new rays and their effects, as a name ought to be fairly descriptive and clearly discriminate the thing named from other things. Many of the terms which have been suggested, as, for instance, the words radiograph, radiography and their derivations, might be useful as provisional and temporary designations for the new picture and process, it being understood that they are given a special technical sense merely for convenience. The danger would be that they might become fixed by use, and so continued after strictly appropriate terms have been suggested by more complete knowledge of the nature of the phenomena. The words do not differentiate the pictures from those produced by other radiations, as light or heat, which is a defect. The same objection applies to all the names signifying shadow-pictures, and besides the pictures are not mere shadows, but have a perspective effect, from the varying depth of shade dependent upon different thickness, structure, or facility of transmission of the rays. The word electrograph more nearly meets the requirements of a name, but that also might be appropriately applied to Nobili's figures, the Lichtenberg figures, and the like. We may yet find that the pictures are a secondary effect produced by luminous rays generated by the electrical action—then what should they be called? For my part, I am still inclined to call them simply cathode pictures, since their dependence upon the cathode stream, directly or indirectly, is almost all that is really determined about them as yet; or even Röntgen pictures, in a general way, and would postpone the selection of fixed terms until something definite is known as to their origin.

Mr. Charles Proteus Steinmetz, Schenectady, N. Y.:

I do not think it advisable at present to choose any appropriate name for Röntgen pictures, not as long as so very little is known of the nature of these rays, and the action causing the photograph. It is, for instance, not definitely settled whether the photographs are due to the direct chemical action of the Röntgen rays, or whether they are ordinary photographs caused by fluorescent light due to the Röntgen rays. As soon as more becomes known of these phenomena, an appropriate name will be given to these shadow pictures, if it should be found necessary, which I doubt. I may add that it is remarkable how barren in scientific results in this line the work of the experimenters on this side of the Atlantic has thus far been. It

appears to me like a race to find who could get the nicest and clearest picture of a skeleton of a hand, or something like that, while the scientific importance of these phenomena seem to have been utterly lost sight of. It is not known what kind of radiation these Röntgen rays are. If they are ultra-violet rays the apparent absence of refraction seems to point to a wave length small in magnitude compared with the dimensions of the molecules, and the spectrum of light would thereby be extended far beyond the limits of the previously known ultra-violet; and between the extreme ultra-violet and these Röntgen rays a region would exist where refrangibility gradually ceases. If these Röntgen rays are longitudinal waves of considerable wave length they would constitute a new kind of radiation never before recognized, and incompatible with our previcus views on the nature of the light ether. As you see, the solution of these questions is of an intrinsic scientific interest, and thus an importance far in excess of all the shadow pictures taken by means of these rays; it is thus to be pitied that apparently the interest of investigators has been deflected from these more important problems of scientific investigation to that of getting nice photographs thrcugh opaque bodies.

Alex. Roy, Toronto, Ont.:

Referring to your editorial query in THE ELECTRICAL WORLD of March 21, I suggest that the word "ethergraph" be applied to the Röntgen feature.

Max Osterberg, Fellow Columbia College, New York:

I have as yet not seen any reason for changing my opinion as to the propriety of using the word skotograph for the picture obtained by the Röntgen process. My claims for a favorable consideration of this word are these: First: It is phonetic. Second: It is derived from the Greek throughout. Third: It is a universal expression, being applicable just as it stands in English, French and German. Fourth: It is analogous in form with such words as photograph, telegraph, etc. Fifth: The verb (to skotograph) and the noun (skotography) are easily derived. Sixth: It contains the proper meaning, since *skotos* is darkness, that is to say, it depends upon the relative density of bodies, whether darker or lighter in effect. I am at a loss to see any disadvantage in the word, except perhaps the fact that it ought to be left to Prof. Röntgen to coin an appropriate term. All other words are, in the writer's opinion, wrong in form or carry the wrong meaning. To quote but a few: Radiograph does not express the process, and is used for naming an instrument at present. Sciagraph, or, better, skiagraph, means simply a shadow picture, which, in my opinion, is not as good, as Röntgen rays do not produce shadows, in the true sense of the word. Rōntgraph, or Rœntgraph, or Rontograph, or Roentgengraph, do not, to my mind, appear phonetic, and if we want to connect, as we should, Rōntgen's name with the process, we can speak as we do of Röntgen rays, and when we have sufficiently advanced to measure their intensity, we may express the unit of measure as *one Röntgen*. All other words proposed or used are too bad to deserve special mention.

Townsend Wolcott, New York, N. Y.:

Of all the names mentioned, skotograph appears to be the best. It is an easy word, more euphonious than skiagraph, (which is the only other one of comparable merit) is equally good Greek, and is free from another serious objection which pertains to the latter. We already have the English word sciagraph, defined by Webster as "An old term for a vertical section of a building"—that is, a technical term in architecture. Also sciagraphy, which, according to the same authority, is derived from the "Greek σκιαγραφία; from σκιαγραφος, drawing in light and shade: σκια, a shadow; ψγράφειγ, to delineate, describe." Webster's definitions are: "1. The art or science of projecting or delineating shadows as they fall in nature. 2. Architecture, same as sciagraph." As these two words already exist with accepted meanings, it would, in any event, be better to have a new word, but considering the pronunciation, the case becomes much more urgent. The average man (English speaking) would be likely to pronounce sciagraph as though it were spelled skyagraph, the man with even a smattering of Greek as though it were skeeograph; but according to Webster the *sci* has the same sound that it has in the word science, that is siagraph. Skotograph is from the Greek σκότος, which Webster gives under the head of Indo-Germanic roots as "darkness, from σκοιός, dark, from σκιά, from Sanskrit *chaya*, shade." Etymologically, therefore, the words skiagraph, or sciagraph and skotograph are nearly related, and it would seem that skotograph is somewhat preferable on account of its describing the process better than the others, even independently of the objection to the others already cited. It should be spelled with a *k*, partly on account of its derivation, but chiefly to avoid the possibility that any one should think it had any relation to the proper name Scot, and also because the long *o* would more probably be sounded, which is correct according to Webster. Radiograph is too generic; Röntograph is disrespectful rather than complimentary to the eminent savant to whom we owe the art; cathodograph conveys a wrong impression, and the rest are notworth mention.

Prof. Alexander Macfarlane, Lehigh University, South Bethlehem, Pa.:

All the inventors of names to denote the prints taken by means of Röntgen rays agree in taking the Greek verb *graphein* to denote the fact that it is a recording process; but agreement ends there. There is difference of opinion as to whether it should be graph or gram. According to the analogy of telegraph and telegram, phonograph and phonogram, etc., graph is more properly applied to the apparatus, and gram to the result. Photogram, though rare, is a more accurate name for what is usually called a photograph. Hence I think that to denote the print gram is preferable to graph. The principal diversity arises in the choice of the component of the compound word. Shall it be the name of the discoverer, or some characteristic of the prints or the name of the physical agent? It is unfortunate that the name of the discoverer sounds strange to English ears, and does not combine with gram to form a euphonious and easily pronounced word; for Röntgengram would not involve any doubtful theory or bestow an unmerited honor. In skoto, scoto, scia, skia and shadow, we have the idea that the prints are shadow prints; but if the Röntgen picture is not a photograph, neither is it a silhouette. A silhouette or shadow picture gives merely the outline, not the interior. Penetraliogram is a more accurate characterization. Is enough known about the physical agent to introduce it into the name, and so make a contrast to photograph? It seems to me that the Latin word *radius*, a ray, expresses very accurately the physical agent. It is proved that the agent emanates as rays from the fluorescent part of the tube, and is propagated in straight lines in all directions. An objection is made to radiograph in the editorial of THE ELECTRICAL WORLD for March 21 that it is too general, involving light as well as Röntgen rays. But the photographer avoids radiant points and works with diffused radiation. The agent in photography is radiation which emanates from each point of the object depicted, whereas in radiography the agent is rays which emanate from each point in the fluorescent part of the tube, and which have the remarkable property of going through the object depicted without being changed in the direction they have on leaving their source. Hence I think that radiograph is the correct word for the apparatus, radiogram for the print, and radiographer for the coming artist.

Prof. Reginald A. Fessenden, Western University of Pennsylvania, Allegheny, Pa.:

Since this valuable discovery has been generously presented to the public, it would seem only fit that the name of the discoverer should be used. This at once narrows down the terms proposed to those containing as a component the names Lenard and Röntgen. This is the least return which we can make to the man who has freely given this great discovery to the world. Whether to use both or one name, and if the latter, which one, is a more difficult matter to decide. Though Hertz first pointed out that thin golf leaf was transparent to the cathode rays, this might have been explained by the fact, discovered by Crookes for the case of solids, and by Spottiswood for the case of gases, that the place where the cathode rays strike becomes a fresh cathode and anode. The *great* discovery was made by Lenard when he found that from this point proceeded fresh rays which penetrated substances according to their density mainly. He was the first one to take photographs through solid substances. It does not matter what the real nature of the rays be, whether cathode, anode, ultra-violet or infra-red, Lenard discovered them, scientifically investigated them, discovered their astonishing properties, and was the first one to make photographs by their means. Lenard did not, however, make any photographs of the human body, so far as we know. That his rays can do this however is shown by the experiments of Prof. Woodward of Harvard (THE ELECTRICAL WORLD, Feb. 29, 1896). Therefore it would appear to be a matter of justice to call the pictures taken by Prof. Woodward Lenardographs, since they were obtained with a Lenard apparatus and by means of rays whose properties had been discovered and investigated by Lenard.

After the publication of Lenard's results Röntgen also produced pictures, which, as in the case of Lenard's, seem to depend mainly upon the density of the substance imaged. The question then arises: "Has Röntgen simply reaped the fruit of Lenard's work, or has he discovered something new?" Since Röntgen has stated positively that his rays differ in several ways from those of Lenard, we are bound for the present, and it is to be hoped always, to suppose that he has made a discovery. Photographs taken by Röntgen's method are, so far as can be noticed at present, absolutely undistinguishable from those of Lenard. Moreover, the apparent non-deflectibility of Röntgen's rays may only be a matter of degree, in which case Lenard's name should stand alone.

Yet there are equally good grounds for the hope that Röntgen has also made a discovery. Should this be confirmed and his rays be shown qualitatively different from Lenard's, then we ought, it appears to me, to call pictures taken by his rays Röntgengraphs (the termination being a matter of opinion).

In this connection I would mention one fact that appears to have been overlooked. This is that the rate at which metals volatilize when made cathodes in a high vacuum is approximately proportional to their opacity to the Lenard and Röntgen rays. Crookes found that when different metals were made cathodes in a vacuum they volatilized at the following rates:

Palladium	180	Brass	51	Indium	10
Gold	100	Platinum	44	Iron	5
Silver	82	Copper	40	Aluminum	zero.
Lead	75	Cadmium	32	Magnesium	zero.
Tin	56	Nickel	11		

This is very suggestive and has influenced me in the line of work undertaken. I might also say that my own results confirm the statement that the best results are obtained by focussing the cathode rays upon a thin platinum foil anode, and preventing them so far as possible from touching the glass. Such a tube works dark, does not heat much, gives very strong effects and holds its vacuum well. In some experiments I have used a magnesium cathode with results which were better than when an aluminum cathode was used.

National Conference on Standard Electrical Rules.

To the Editor of The Electrical World:

SIR:—At the recent meeting of the National Conference on Standard Electrical Rules, in common with the electrical interests the American Street Railway Association was represented, and for the first time was consulted with regard to the various electrical rules now enforced by the insurance companies. The following committee was appointed to formulate a new code of rules to be submitted to the next meeting of the National Conference, June 25 and 26:

Francis B. Crocker, Chairman, American Institute of Electrical Engineers; Wm. J. Hammer, ex-officio, President National Conference on Standard Electrical Rules; Frank R. Ford, American Street Railway Association; William H. Merrill, National Board of Fire Underwriters; Alfred Stone, American Institute of Architects; E. A. Fitzgerald, Underwriters' National Electric Association; William Brophy, National Electric Light Association; E. V. French, Associated Factory Mutual Insurance Companies.

The undersigned, as representing the American Street Railway Association, has been requested to secure suggestions from the members of the association, and from all other street railway companies, engineers and allied manufacturing interests with respect to such changes or additions to the present rules as may seem advisable.

The importance of this work, in its bearing upon street railway construction, and the opportunity now offered to street railway interests for the first time to participate in a movement in which they are so vitally concerned, should not be overlooked. The Committee on Rules depends upon the active co-operation of all parties at interest in order to secure full presentation of all changes that might be beneficial in the formulation of a new code.

The present rules relating to electric railways are as follows:

37. All rules pertaining to arc light wires and stations shall apply (so far as possible) to street railway power stations and their conductors in connection with them.

38. *Power Stations*:

Must be equipped in each circuit as it leaves the station with an *approved* automatic "breaker," or other device that will immediately cut off the current in case the trolley wires become grounded. This device must be mounted on a fireproof base, and in full view and reach of the attendant.

Automatic circuit-breakers should be submitted for *approval* before being used.

39. *Trolley Wires*:

a. Must be no smaller than No. 0, B. & S. copper or No. 4, B. & S. silicon bronze, and must readily stand the strain put upon them when in use.

b. Must be well insulated from their supports, and in case of the side or double-pole construction, the supports shall also be insulated from the poles immediately outside of the trolley wire.

c. Must be capable of being disconnected at the power house, or of being divided into sections, so that in case of fire on the railway route the current may be sent off from the particular section and not interfere with the work of the firemen. This rule also applies to *feeders*.

d. Must be safely protected against contact with all other conductors.

40. *Car Wiring*:

Must be always run out of reach of the passengers, and must be insulated with a waterproof insulation.

41. *Lighting and Power from Railway Wires*:

Must not be permitted, under any pretense, in the same circuit with trolley wires with a ground return, nor shall the same dynamo be used for both purposes, except in street railway cars, electric car houses, and their power stations.

42. *Car Houses*:

a. Must have the trolley wires properly supported on insulating hangers.

b. Must have the trolley hangers placed at such a distance apart that in case of a break in the trolley wire, contact cannot be made with the floor.

c. Must have cut-out switch located at a proper place outside of the building, so that all trolley circuits in the building can be cut out at one point, and line circuit-breakers must be installed, so that when this cut-out switch is open the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building whenever the same is not in use, or the road not in operation.

d. Must have all lamps and stationary motors installed in such a way that one main switch can control the whole of each installation (lighting or power), independently of main feeder switch. No portable incandescent lamps or twin wire allowed except that portable incandescent lamps may be used in the pits; connections to be made by two approved rubber-covered flexible wires, properly protected against mechanical injury; the circuit to be controlled by a switch placed outside of the pit.

e. Must have all wiring and apparatus installed in accordance with rules under Class B.

f. Must not have any system of feeder distribution centering in the building.

g. Must have the rails bonded at each joint with not less than No. 2 B. & S. annealed copper wire; also a supplementary wire to be run for each track.

h. Must not have cars left with trolley in electrical connection with the trolley wire.

43. *Ground Return Wires*:

Where ground return is used it must be so arranged that no difference of potential will exist greater than five volts to 50 feet, or 50 volts to the mile between any two points in the earth or pipes therein.

At the meeting of the National Conference a number of topics were suggested that might advantageously be incorporated into new rules. Some of these are here presented for the consideration of street railway interests, merely as an indication of general lines upon which there may be necessity for revision, and with the hope that they may evoke a very general expression of opinion from all concerned:

Increased protection of lighting circuits; method of grounding generators; double insulation for trolley wires with iron pole construction; car wiring in moulding and interior conduit; automatic magnetic circuit-breakers for cars; electric brakes; electric car heaters; use of lights for railway circuits in buildings operated by street railway companies, such as amusement pavilions, repair shops, waiting rooms, etc.; rail bonding; arc lamps on railway circuits.

It has been suggested that the new rules should cover very fully the subjects of car wiring and outside construction. They should deal not only with construction objectionable from the standpoint of fire hazard, but also with respect to personal danger.

All suggestions should be forwarded at an early date in order to secure full discussion, as the committee has but a limited time in which to consider and report upon recommendations to the conference.

FRANK R. FORD.

303 Broadway, NEW YORK.

Tungstate of Calcium Fluoroscope.

To the Editor of The Electrical World:

SIR:—Messrs. Aylsworth and Jackson, of East Orange, N. J., have presented me, on behalf of Mr. Thomas Alva Edison, with a tungstate of calcium fluoroscope. It is a magnificent piece of apparatus, and will undoubtedly prove of the greatest service in the new field of work opened up by Röntgen's discovery. I cannot speak too highly of its merits, and I take much pleasure in recommending it to all who are interested in Röntgen radiance. I wish to state also that this recommendation is spontaneous, and not in any way suggested or even hinted at by the generous donors.

Mr. Edison and his assistants, Messrs. Aylsworth and Jackson, deserve the deepest gratitude on the part of scientific men and the public at large for their magnificent fluorescent screens.

NEW YORK. M. I. PUPIN.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Paralleling Alternators. HAMMOND. Lond. *Elec. Eng.*, March 13.—The beginning of a reprint in abstract of a recent paper; it is partially historical in character but the greater part is devoted to pointing out the present position of parallel running in the United Kingdom; he favors joining all the circuits and alternators to one bus-bar or possibly two, as that is the only way in which a plant can be run at its highest efficiency; he gives a summary of the answers to a number of questions sent out to managers of alternating stations inquiring about the behavior of the alternators under various conditions, the answers being divided into those referring to machines with iron in the armature and those without iron; so far no conclusions have been drawn. The paper is discussed somewhat unfavorably in the Lond. *Elec. Rev.*, March 13. It is claimed that the paper contains a few matters of interest, but that it is exceedingly difficult to draw deductions of value from them; it is thought that now it is no longer important to bring machines into phase before paralleling; if the speed is slightly above synchronism and the machine then switched on, it will easily fall into phase; elaborate arrangements for showing the instant of co-phase synchronism, as found on the average switchboard, are not thought to be of much practical use; parallel running of alternators is working very satisfactorily.

Rotary Transformer. MERSHON system. *Elec. Eng.*, March 25.—A brief, illustrated description of his system; he found that by transforming an alternating current into a large number of phases and leading these currents to the rotary transformer, the loss in the latter is decreased, or in other words, the capacity is increased; by thus passing a three-phase current through six sliding contacts to the windings of an armature, the output of the transformer will be about 40 to 45 per cent. greater than if the three main conductors had been connected directly. This increase in output, he thinks, is due to the fact that the alternating currents are then conveyed more directly to the continuous-current brushes without passing through the armature winding, and there will then be less loss in these windings.

Transforming Direct Currents. West. Elec:, March 28.—The Davis system is briefly described and illustrated; the object seems to be to transform a continuous current into an alternating one of high voltage for long-distance transmission and then to transform it back again at the receiving end; it consists of rotary commutators driven by a motor, those of the receiving end being apparently driven by a synchronous motor; the distinctive feature seems to be that two or more transformers, each with its pair of pole changers, are used for each circuit, the commutators reversing at different times, the object being to have a more uniform continuous current.

Graphical Method for Studying the Action of the Compound Dynamo. PLACE. *Rose Technic*, March.—In testing a shunt or compound dynamo for its characteristic curve, the speed of the armature does not always remain constant for all loads, and when it is desired to know how much the observed differ from the correct values of the current and potential, a calculation becomes necessary; in the present article he describes a graphical method of making this calculation.

Paralleling of Alternators. HAMMOND. *El'ty*, March 25.—A reprint in abstract of the paper noticed above.

LIGHTS AND LIGHTING.

Continuous and Alternating-Current Arcs. FLEMING. Lond. *Elec.*, March 13.—A communication supplementing the abstract which was noticed in the *Digest* last week. It should have been stated in the original abstract that lowering the frequency increase (not decreases, as was there stated) the efficiency of the alternating arc; some of the editorial remarks are replied to; part of the paper referred to the mean spherical candle-power of the two arcs, each supplied with the same carbons and the same power, one being an alternating and the other a continuous-current lamp; any variables that were important were not left to take care of themselves, as previously stated; he states that it is perfectly clear that the alternating arc "has a long lee way to make up before it can rival its continuous-current brother, even though aided by a carbon which secretly and specially prepares itself for alternating-current work."

Incandescent Lamp Efficiency. STUART-SMITH. *Jour. of El'ty*, February.—He points out the desirability of increasing the life of incandescent lamps at the same efficiency, and suggests methods by which it might be accomplished. As far as the globe is concerned there is but one method of maintaining its efficiency, which is by preventing the production of opaque deposits; as to the filament, there are two methods; the first is the prevention of the removal of material from the filament by vaporization or otherwise, and the second by making the removal of the material uniform over the entire surface; the structure of the filament should therefore be absolutely homogeneous, so that the density of vaporization is the same all over the surface. In a confined space every substance is surrounded by an atmosphere of its own vapor, and when this space is filled further vaporization cannot take place unless the vapor density is lowered by deposition; at the temperature of the filament vaporization of carbon probably takes place very freely, and the vapor density in the burning lamp is comparatively great. If the filaments are not homogeneous, vaporization will be more rapid from one point than from an adjacent one, forming pits; when these pits have such a depth that the light from the bottom is half a wave-length behind that from the top, interference would set in with a resulting diminution of light; when this loss by interference is equal to the gain which is known to take place, the illumination will reach a maximum, but the loss due to interference will increase with the number of pits and will diminish as the depth increases, ceasing when this depth is equal to a full wave-length. Theoretically there should therefore be a series of maxima and minima, were the life of the filament long enough; this was shown in some curves which he published in THE ELECTRICAL WORLD, March 3, 1894. Vaporization cannot be prevented entirely, but in the presence of other vapors; a longer period is required for the density due to the temperature to be attained; by taking advantage of this it might be possible to prevent vaporization to a large degree; any heavy vapor ought to be to some extent beneficial; some effect of this sort may be the true explanation of the action of bromine; it tends to condense on the glass, through which layer the carbon may not be able to pass to reach the glass, deposition being thus largely prevented; if this is the correct way to prevent v porization a careful study of various gases should be made with reference to their behavior in the presence of glass.

Lighting by Holophane Globes. GUILBERT. *Prog. Age*, March 1 and 16.—A translation from the French of the long article abstracted in the *Digest*, Dec. 28, Jan. 25 and Feb. 1, including all the illustrations.

Fredureau Diffusing Globe. El'ty March 25.—A reprint of Thompson's report which was abstracted in the *Digest* last week.

Lighting Residences by Electricity. NOLL. *Eng. Mag.* for March.—A short article giving general hints and instructions for this kind of work.

POWER AND HEAT.

Electric Elevators. Lond. *Elec. Rev.*, March 13.—A continuation of the discussion, which is chiefly of local interest.

Lower Niagara Falls Power Plant. Eng. News, March 26.—A brief, illustrated description of the plant which is to be erected below the falls by the Hydraulic Power Company.

Artistic Engine Room Interiors. ADAMS. *Eng. Mag.* for March.—An article containing a number of illustrations of engine rooms for electric lighting and power plants.

Electric Vulcanizer. Ind. Rub. World, March 10.—An illustrated description of a small electric heating apparatus for vulcanizing repairs of punctured bicycle tires; it consists of a flat slab heated by means of an electric current from lighting mains, and a device for producing the necessary pressure.

TRACTION.

Electric Railway Statistics for Europe. L'Ind. Elec., March 10.—Tabulated statistics in the form of a 16-page supplement, giving the principal data in 16 columns, of all the electric railways in operation, under construction and projected, in Europe, from the first of January, 1896; it is no doubt the most complete table published. During the year the number of lines operated increased from 70 to 111, their length from 700 to 902 km, the output of the power-houses from 18,150 to 25,095 kw and the number of motor cars or locomotives from 1,236 to 1,747. Germany remains at the head of the list with 406 km of lines, France coming next with 132, England with 94 and Ireland with 13. The trolley system is the one most universally used, 91 of the lines being operated by this system; 3 use the underground conductor, 9 use the central rail, and of these, 8 are in Great Britain; 8 lines are operated by accumulators. For convenience in mak-

ing comparisons the statistics for the first of January, 1895, are also given briefly.

Inclined Railway. Eng. News, March 26.—A brief, illustrated description of a novel passenger elevator at Great Falls, Mont. Economy in first cost and operation were the ruling conditions; the height is 100 feet, the angle of incline 22 degrees 10 seconds; the track is 400 feet long, and there is a counterbalance car of double the weight, on a side track half as long, the two cars being connected by a one-inch cable through the medium of a drum at the top of the incline; the passenger car accommodates 16 people; the motive power is a 15-hp street railway motor, which obtains its current from an overhead trolley wire; there is no rack and pinion; the round trip is made in two minutes; it has been operated very successfully for nearly two years; it is said to be the steepest incline worked by electric power; a local authority states that in his opinion the rack and pinion system is to be preferred for such work, but the present system is novel and economical.

Electric Locomotive. Eng. News, March 12.—A brief description of the one designed by Walkins, to be used on a railroad from Madison, Ind. to Cincinnati, a distance of about 60 miles; it is built of the same type as the Heilmann locomotive and contains a steam boiler, steam engine, electric generator and electric motors; there will be two generators of 400 horse-power each; also two Westinghouse motors of 350 horse-power which will transmit the power to four driving wheels 6 inches from the edge of the rim; there will be a storage battery of sufficient capacity to move the locomotive to a side track in case of an emergency; the trailing truck will carry a motor of 200 horse-power for an emergency; the principal data and dimensions are given.

Alternating Currents for Railways. HOUSTON AND KENNELLY. *Elec. Ry. Gaz.*, March 21.—A note to the effect that there appears to be no advantage in using alternating currents for street railways, as the chief objection to the continuous current is the electrolysis of the buried pipes, which it is claimed can very easily be avoided; moreover there will be greater danger to life in the use of alternating currents; multiphase currents require at least two trolley wires. For high speed, long distance or interurban railways, the conditions are different and for these it is thought there is a wide field for the alternating current; there is less objection in these to a double trolley; the rush of current at starting can be controlled by reactive coils.

Trolley Cars and Surveying Instruments. Eng. News, March 26.—Attention is called to the effect on the magnetic needles of surveying instruments, of carrying them on trolley cars, as the magnetism of the motors affects that of the needles, either reversing the magnetism completely or changing its intensity, which, by altering the angle of dip for which the needle is balanced, causes it to touch the glass; surveyors are advised to enter and leave the trolley cars by the rear door and keep their instruments as far away from the motors as possible, say on the rear platform. It is also stated that the United States Geological Survey is having trouble in determining the magnetic variation in Philadelphia, as the earth beneath the city is so filled with electric currents that compass needles behave in a most eccentric manner.

Rigid Rail Joints. Elec. Ry. Gaz., March 21.—A note showing by means of a simple calculation why the expansion and contraction does not make it impossible to use rigid rail joints; it is shown that the amount of expansion and contraction is considerably below the elastic limit: the strain, however, is sufficient to break defective joints, but after these have been detected and repaired the track has a uniform strength.

Rail Bonds. St. Ry. Jour., March.—A short article giving a brief summary of the subject, and an illustrated description of the principal bonds used in this country at present.

Electricity on Steam Railways. BAXTER. *Elec. Eng.*, March 25; a continuation of his serial (*Digest*, last week).—He discusses the various other items in the operating expenses which can be reduced by the adoption of electricity, among which are a reduction in the labor account, the absence of the cost of supplying fuel and water along the line, etc.

Mechanically Propelled Carriages. Eng. News, March 5.—A description of the laboratory tests of the *Times-Herald* contest; also an illustrated description of a number of recent American forms. The same number contains an article on the possibilities of such vehicles for country roads.

Electric Railways.—Elec. Ind. for March contains an illustrated description of the Detroit Citizens' Railway. The *St. Ry. Jour.* for March contains a long, well-illustrated description of the Portland, Me., railway; also a brief one of the road at Aix-la-Chapelle and some recent railways in France; also an illustrated description of some recent constructions in connection with the West End plant in Boston. The *Jour. of El'ty* for February gives an illustrated description of the Sutro railway in California. The *Elec. Ry. Gazette*, March 21, contains a brief, illustrated description of the New York, Elmsport & White Plains railway.

Third Rail. St. Ry. Rev., March 15.—An illustrated description of the third-rail and feeder equipment on the Lake Street elevated road in Chicago.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

High Voltage Lamps and Their Influence on Central Station Practice. ADDENBROOKE. Lond. *Elec. Eng.* and *Elec. Rev.*, March 13.—A continuation of his paper (*Digest*, last week). He discusses the effect on the distribution of using high voltage lamps; the advantages may be said to progress as the cube of the voltage up to about 200 volts; at this voltage 9 or 10 times the area could be better served on a three-wire system from a single station than is now the case at 100 volts; this applies to the feeders and even to a greater degree to the distributing system; in the latter there is an inconvenient fall of voltage leading to unsatisfactory lighting, and this would probably vanish at 200 volts, the fall of voltage in the houses being then merely nominal. He discusses in some detail the effect on the distribution; in the centre of large towns there are perhaps 30,000 inhabitants per square mile, although ordinarily it is not more than 16,000; a low voltage station can serve economically about 60,000 to 70,000 in large towns, and about half that in provincial towns; on this basis 70 to 80 stations would be required for the whole of London, not including the extreme suburbs; by doubling the voltage very different results are obtained; the area lighted from each station would then be 16 times as large; but instead of extending the feeders four times the distance he limits it to three times, thus securing better regulation; on that basis an area of nearly 25 square miles could be covered from one station, that is, eleven times the former area; one station could therefore serve 700,000 people, making six or seven stations for London; two stations or at most three will be sufficient for most other large cities in Great Britain, including the suburbs for several miles; for the average town, one station would be ample; in his calculations he assumes that a 16-cp lamp takes one third of an ampere at 220 volts; he takes as a limit an extreme fall of 2 per cent. in the distributing system from the feeder point to the farthest lamp; he gives a table which is claimed to show at a glance the best method of designing the mains and their cost; the third wire need not be more than $\frac{1}{8}$ as large as the other two, except in the distributing system; the table refers to the feeders on the above basis; the weight of a set of mains would be 20 tons per mile and the cost about $6,000 for the copper; a table is given to show the reduction in the fall of voltage, due to a reduction in the current, and also the cost of the copper; assuming 250 amperes per square inch, the drop would be about 1.5 per cent; assuming that each feeder feeds half a mile square, the extra cost of copper per lamp lighted will hardly be more than one dollar per 16-cp lamp, while the mean cost would be about ¼ of this, and the mean drop 1 per cent.; for feeders about 2.25 miles long and a network extending a quarter of a mile further, the extreme cost of copper per 16-cp lamp lighted will be about $11, but this is in extreme cases; ¾ of this may be taken as an average, including both feeder and network, for an area of 25 square miles; the maintenance and interest on capital for the copper in the distributing system amounts to 0.66 cent, or $\frac{1}{6}$ of a cent per kw of current sold, or 12 cents per kw-hour; the interest and maintenance on the copper in the distributing system represents less than 6 per cent. of the cost of the current; ¾ of the copper is in the feeders and ¼ in the distributing system. Another table gives the cost of insulating and laying the cables; from this the actual cost of the feeders is about 10 per cent.; for a two mile feeder of armored cable at 250 amperes per square inch, the cost, laid and complete, would be about $275 per kw for the maximum output, the fall of voltage being about 10 per cent.; he thinks that the whole distributing system, including the feeders, service boxes and every other item, the wires being laid, with a service extending 2.5 miles in all directions, could be laid complete for $300 per kw, which is very moderate as compared with the present sums expended; he thinks a very good profit could be made by selling current at eight cents per kw-hour for lighting and five cents for power purposes. The cost for such a system would not be as low as that for an alternating system at 2000 volts with transformers and 220-volt lamps; a direct supply station is as cheap in capital cost, over an area having a base of at least 3.5 miles and covering 10 square miles; if the transformer station uses 100-volt lamps the comparison is much more decidedly in favor of direct supply at 220 volts; he does not think it probable that any direct supply station in the future will be operated without accumulators, hence there is no need in going very minutely into this comparison with transformer systems. The paper is to be continued. The discussion of the paper is given briefly in the Lon. *Elec. Eng.* March 13, but it appears to contain nothing of special interest.

Central Station Costs. Lond. *Elec.*, March 13.—A supplement in the form of a large table giving the total capital outlay, receipts and expenditures for the year 1895 of statutory electric supply undertakings in London and the provinces; those for the provinces are divided into stations owned by companies and those owned by municipalities; no editorial deductions are given.

WIRES, WIRING AND CONDUITS.

Wiring. Lond. *Elec. Rev.*, March 13.—A few communications discussing the subject. One writer claims that it is by no means impossible to make a connection on the concentric cable while current is passing, and states having made such connections on cables carrying currents at over 2,000 volts; he describes a way in which connections to live concentric cables may be made, when the voltage is 100 to 150.

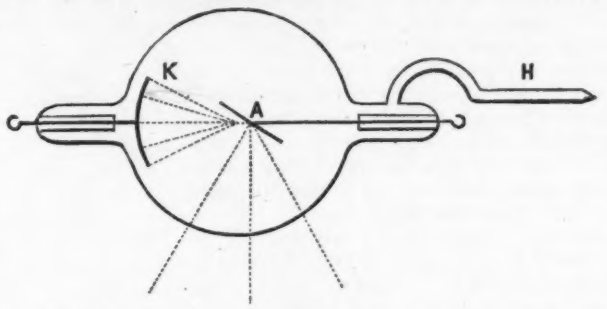
Cast Iron and Stoneware Conduits. Lond. *Elec.*, March 13.—A brief discussion, followed by an illustrated description of the Doulton stoneware conduits.

ELECTRO-PHYSICS AND MAGNETISM.

Roentgen Rays. L'Ind. Elec., March 10, is devoted almost exclusively to reprints of Academy papers, most of which are on Roentgen rays and allied subjects; some of them are reprinted in *L'Elec.*, March 14; brief extracts from some of them are also given in the Lond. *Elec.*, March 13; the the following is a brief summary of the more important points in all these papers: Meslans experimented to find the effects of the chemical composition of bodies on their action toward Roentgen rays; he noticed the extreme transparency not only of carbon in its various forms, as compared with the other metaloids, but also the small opacity of organic compounds when they contain together with carbon one of the gaseous elements, such as hydrogen, oxygen and nitrogen; this transparency is far from being uniform and appears to depend on the chemical composition; diamond, graphite, anthracite and the carbon of sugar give weak images, like those of wood and paraffine, white sulphur, selenium, phosphorous and iodine show great opacity; organic materials, ethers, acids and nitrates are easily traversed, but the introduction in an organic molecule of a mineral element, such as iodine, chlorine, fluorine, sulphur, phosphorous, etc., makes them very opaque; iodoform is very opaque, while the alkaloids, picric acid, urea and fuchsine, are very transparent; metallic salts are quite opaque, but this varies with the metal and the acid. Londe found that the impressions were much more "energetic" on rapid plates, and that the darkness of the image was directly proportional to the sensitiveness of the plate; photographic plates therefore behave toward these rays exactly as they do toward light, hence he favors the use of extra rapid plates. Zenger showed the want of homogeneity in the impressions obtained from wood, which are striated; this interferes with the clearness of the image; he therefore recommends placing the object directly on the sensitive plate, interposing only a very homogeneous black paper, as the image will then be much clearer and the time of exposure reduced; he also recommends the use of high voltages in order to enable one to place the tube as far off as possible, which will increase the sharpness of the image. Swyngedauw showed that the X-rays lower the explosive potentials according to the same general laws which govern the ultra-violet radiations; he suggests this as a method of measuring X-rays; these rays lower the explosive dynamic voltages in a much greater proportion than the static voltages. A paper by Righi contains nearly the same matter as that in his previous paper, abstracted in the *Digest*, March 14; the discharge of a plate is about equally rapid whether it be positive or negative; if the initial charge is positive, the discharge is not complete, but when it is negative the discharge is not only complete, but a positive charge is subsequently produced thereon; a disc in its natural state is charged positively as with ultra-violet rays; with the same disc the final positive charge is the same whatever was the initial value, whether positive, negative or zero; it is greater for copper than for zinc and still greater for retort carbon; a plate of glass nearly 1 cm thick diminishes but does not prevent this action. Borgman and Gerchun state that their experiments do not completely confirm the results obtained by Thompson (*Digest*, Feb. 29); a disc of zinc charged positively loses its charge almost instantly and subsequently takes a negative charge which increases up to a certain degree; when charged negatively there is also a loss, which, however, is much slower and stops at a certain degree; when this is reached the angle of divergence of the leaves of the electroscope oscillates continually, becoming greater and less, depending on the irregular action of the interrupter; a disc of aluminum connected to earth diminishes the action without changing its character; these experiments are thought to demonstrate that the rays can communicate a negative charge to a body. In another experiment the rays were directed onto two platinum spheres connected with a Ruhmkorff coil which were separated so far that a spark did not pass, but the moment the rays were directed onto the exciters a stream of sparks was produced, which shows that these, like the ultra-violet rays, increase the explosive distance of a static discharge. Benoist and Hurmuzescu state that they have verified that these rays are propagated in air according to the law of inverse squares; also that the Roentgen rays are heterogeneous, which they base on the fact that the coefficient of transmission of 0.1 mm thickness of aluminum is 0.85 which is incompatible with the transparency observed by Roentgen for a plate 15 mm thick, on the assumption that the coefficient does not increase with the thickness, that is, if the X-rays are not subject, when passing through aluminum, to selective absorption, which is a proof of their heterogeneity; they found that the coefficient increases from 0.85 for sheets not exceeding 0.6 mm thick, to 0.9 for sheets exceeding 1 mm; for different tubes the coefficient varied from 0.85 to 0.78. Auguste and Lumiere studied the photographic effects of the rays and found that plates sensitive to red, yellow and green light give exactly the same impressions, everything else being the same, assuming that they have the same general sensitiveness to white light; they have not been able to find the presence of X-rays in sources of light. They made experiments to ascertain the absorption through sensitive filaments; in 10 minutes' exposure photographic effects were produced through a package of 250 sheets of gelatino-bromide-silver paper; 300 sheets of paper without the bromide emulsion exercised the same absorptive effect as 150 sheets of sensitized paper; they also experimented with plates having different degrees of sensitiveness for white light in the ratio of 1.8 to 30 and found that this ratio was exactly the same for Roentgen rays. Becquerel experimented with the radiation emitted by phosphorescence, from which he concludes that a double sulphate of uranium and potassium emits radiations which pass through paper opaque to light and reduce the silver salts. Zenger and Domalip obtained electric images by means of plates of brass, zinc and lead and steel, which they believe proves that it is only an induction phenomena which produces the phosphorescence of the gelatine and at the same time the electric discharge in the gelatine, as also the fluorescence of the surrounding air, as in the needle discharge; it is thought that it is these three agents which determine the decomposition of the silver salts in the sensitive plate; a more rapid action is obtained with orthochromatic plates of eosine or with plates washed with a solution of sulphate of quinine; all substances which can transform electric movements into undulatory movements, that is, produce fluorescence and phosphorescence, contribute greatly to the production of these images. Buguet and Gascard showed different impressions produced by the true and the imitation diamond; in long exposures the impression of the true diamond disappears almost completely while the imitation diamond is opaque; the same method enables one to distinguish natural jet from its imitations; besides the photographic method they also tried the optic method, which is direct and depends on the well-known action of the fluorescent screen, on which the shadows of the diamonds will be much clearer than those of the imitations. Dariex and De Rochas endeavored to find the degree of permeability of the media in the eye, which showed why these X-rays are invisible; they made experiments with the eyes of freshly killed pigs which showed that the media of the eye, which is so transparent to light, is but very little so to X-rays. Meslin showed that the active rays do not come directly from the cathode but seem to originate in that part of the glass which is fluorescent. Defour placed a plate of aluminum on a piece of ebonite screwed to an insulating rod and enclosed the whole in a metallic box connected to earth, the plate being connected to an electrometer; the rays from the Crookes tube acted through a window in the metallic case, on the aluminum foil; the radiations discharge the aluminum plate when negatively electrified; the effect is the same with a disc of gold, and also when it is electrified positively; it affords a means of measuring the relative absorption of different metals; he found that fluorescence was produced not only in front of the glass opposite to the cathode, but also in front of the anode and more or less over the surface of the glass; the fluorescence on a piece of paper covered with fluorescent material increases as the fingers or metallic bodies are approached toward this strip of paper; he believes that photographic action is produced by a phenomena analogous to an electric effluvium which is very homogeneous and finely divided, the existence of which is manifested by its electric properties; he concludes that actinic radiations emanating from the surface of the tube and acting on a sensitive plate appear to have an electric origin; that they constitute a phenomena analogous to an electric effluvium and act like it on the photographic plate; the permeability of bodies varies with their dielectric constant and their electric conductivity, and has no relation to the optic properties. Piltchikof believes that effective rays seem to come from the fluorescent glass, and he therefore thought that the effect would be increased by using a more fluorescent glass; he therefore used a Puluj tube, and found that the time of exposure was diminished thereby. D'Arsonval discussed the controversy between Le Bon and others and believes to have found the cause of the discordant results; he obtained no impressions when the plates were exposed to solar rays; if a piece of uranium glass is placed on the metallic cover of a plate case, the impression is made more rapidly; those which give the best results fluoresce with a greenish-yellow light when illuminated by an electric spark; all incandescent lamps which have a greenish-yellow fluorescence can be used in place of a Crookes tube, but those in which it is violet or bluish are almost useless; he concludes that all bodies which emit fluorescent radiations of a greenish-yellow color can form impressions on a photographic plate through opaque bodies; the part taken by the cathode rays he believes is limited to exciting a fluorescence on the special glass forming the Crookes tubes. Becquerel experimented with the invisible radiations emitted by phosphorescent bodies, which traverse opaque materials; among these fluorescent bodies was the double sulphate of uranium and potassium, whose duration of persistence is less than 0.01 second; the radiations from this material after being exposed to the sun traverse not only sheets of black paper but some of the metals; the experiments are described in detail, it cannot be said that the phenomena is due to luminous radiations as these last only a short fraction of a second with this material; he suggests the hypothesis that these radiations, the effects of which are very analogous to those produced by Lenard and Roentgen rays, are invisible radiations emitted by phosphorescence, the duration of persistence of which is infinitely greater than that of the radiations emitted by these bodies. Bonde showed some impressions and states having found that the photographic action is also obtained in a plane perpendicular to that of the cathode rays; he concludes from his observations that the X-rays emanate from all parts of the tube. Imbert and Bertin-Sans believe they discovered the phenomena of diffusion with these rays; if the rays are regularly reflected in the conditions of their experiment, it is only in very small proportion, but they can be diffused in large quantities, the intensity of the diffusion appearing to depend greatly on the nature of the degree of the polish on

the diffusing body; from this they attribute to the new rays a very small wave length, such that it may be impossible to produce the degree of polish necessary for obtaining regular reflection. CARPENTIER showed how a relief impression may be obtained; if a piece of well-annealed thin aluminum is placed on a coin and forced on it with a great pressure, a reverse image of the coin will be produced on the aluminum and if this is then photographed by the Roentgen process, the image of the coin will be obtained. BLEUNARD and LABESSE experimented with the transmission power of liquids; they found that water was easily traversed, solutions of bromide of potassium, chloride of antimony, and bichromate of potash offer a considerable resistance, while solutions of borate of soda and permanganate of potash are easily traversed; the colors do not seem to have any influence on the passage of these rays; water colored with aniline dyes offers no resistance. Mr. NIEWENGLOWSKI claims to have discovered that phosphorescent bodies have the same property of assisting the transmission of solar light as sulphide of zinc has in regard to Roentgen rays. A number of other papers are mentioned but not abstracted.

The Lond. *Elec. Rev.*, March 13, illustrates a new form of tube for producing these rays, which was recently designed by one of the professors at King's College, London, which is claimed to be a very great improvement over anything that has previously been produced and is thought to give a great impulse to the practical applications in surgery; the adjoining figure shows the nature of the tube; the cathode rays are



fixed to a point where they impinge on a plate of platinum fixed on the anode; the rays which produce the photograph radiate from this point, and as it is small the shadow is much sharper; the cathode plate is a concave disc of aluminum; the anode is of platinum and is placed at an angle as shown, a short distance beyond the focus; the cathode rays do not cross like light rays at the focus, but behave more like a number of fluid jets coalescing at the focal point and proceeding thence as a solid parallel jet; very little of the radiation passes through the platinum foil; "the greatest part of the radiation is absorbed by the platinum and given out as X-rays from the luminous point, by a kind of diffuse reflection." The article is accompanied by the photographic record of a hand containing a small fragment of a needle, which was made with this tube at an exposure of only two minutes; the clearness and definition are much finer than of any which have so far been published, the bones of the wrist showing almost as clearly as those in the fingers; the tube was excited by a two-inch spark coil, which shows that powerful and expensive apparatus is not required with this tube; the varying thickness and density of the bones is so well shown in this record that it gives the appearance of shading as in an ordinary photograph. Editorially it is thought that this tube may be considered the greatest advance in X-ray photography that has been made since the announcement of Roentgen's discovery. It is also stated in the editorial that Prof. Hicks and Mr. Porter both have shown that the actinic rays proceed from the anode; the latter shows that the rays appear to proceed from that side of the anode which is next to the cathode, as though they were produced by the splash of a jet from the cathode; it is difficult to account for this effect on the supposition that the rays are due to waves generated at the point of impact; other experiments seem to show that the action is not in all respects similar to the splash of a jet; he recommends for photographic purposes a tube with a curved cathode, converging the streams onto a small plain anode.

Lond. *Elec. Eng.*, March 13, describes briefly a new form of tube devised by Swinton, with which he has obtained superior results; the cathode plate is concave, so as to focus the cathode rays on a point on the piece of platinum forming the anode; the latter is at an angle of 45 degrees so as to throw down rays, which in this case proceed from the platinum; it gives a sharpness of definition otherwise unattainable and there is less chance of the glass being cracked by heat; it must be made of soda and not of lead glass and must be exhausted to a very high degree, though the exact degree was not given; the sealed up tube does not retain the same exhaustion from day to day, owing, he believes, to the absorption of residual gases by the electrodes, condensation on the glass, etc.; (from the brief description this tube seems to be identical with the one illustrated above). The same journal states that Mr. Scott claims to have discovered that Roentgen rays are capable of refraction under certain conditions, which however are not given; also that the light from most fluorescent substances contains a proportion of the new rays, or at any rate will with sufficiently long exposure produce photographs through vulcanite and wood. The same journal contains another communication from Mr. Walker on the subject of "Electricity a Mode of Motion.—The Roentgen Rays. What Are They?"

Longitudinal Light. JAUMANN. Lond. *Elec.*, March 13.—A continuation of the translation of his article (see *Digest*, last week); he discusses the theory of electrical phenomena in rarefied gases; it is mathematical in character.

Roentgen Rays. PUPIN. *Eng. Mag.*, March.—A short, illustrated article describing briefly how to carry out experiments with these rays; it includes an illustrated description of the method in which an alternating current is transformed up, then passes through a spark gap connection with a condenser and second transformer, the secondary of which is used for operating the tube; (the arrangement of the circuits is the one usually employed for obtaining high-tension, high-frequency currents); he also describes how to construct the second high tension transformer; it may be made of two large glass jars, the outer one containing 18 turns of very coarse, well-insulated wire, wound over its surface, and the inner one about 200 turns of fine wire; the inner one is placed inside the outer one and the space filled with very hot paraffine; the outer one is covered with very hot beeswax. In a postscript to the article he states that this apparatus has since been discovered as being too complicated and too severe on the tube; a six-plate Holtz machine gave complete satisfaction and the wear on the tube is small; they even seem to improve with use; the capacity of the jars should not be too great for the size of the tube; with a pear-shaped Crookes tube five inches in diameter, half pint jars give excellent results; a cylindrical tube with external electrodes forms a good substitute for a Crookes tube; the vacuum should be as high as can possibly be obtained.

The *Elec. Eng.*, March 25, contains a short article by Mr. Edison, in which he states that tungstate of calcium made by fusion is extremely sensitive to Roentgen rays as a fluorescent material; if the rays vary as the square of the distance, this salt is six times more sensitive than platino-barium-cyanide; by using this in the tube-shaped apparatus for examining the shadows, it is stated that all the bones of the hand and arm can be seen, and through a block of eight inches of wood the fingers can be seen moving. The next best salt is tungstate of strontium; it may at first seem that the material should be a salt of a heavy metal, but this is not the case; salicylate of ammonia which fluoresces about as strongly as the platinum salt, has the peculiarity that the fluorescence increases with the thickness of the plate, the maximum being reached at a quarter of an inch. A list of other salts and minerals which fluoresce more or less is given; rock salt, which is practically transparent to radiant light and heat, powerfully absorbs the X-rays and gives a strong fluorescence; in a thick cube of fluorite, which is transparent, the fluorescence accumulates, getting brighter and brighter, and continues several minutes afterward; a few vacuum tube phenomena are described. In the same issue Mr. KER gives a number of illustrations of shadow pictures obtained by arc light rays. The same journal contains a short article by Dr. MORTON describing some experiments which he believes seem to demonstrate "that the Roentgen ray is a property neither of the cathode nor of the anode, but rather it proceeds solely and alone from a substance fluorescently excited within a vacuum tube"; electricity then becomes of secondary importance, and is merely a convenient method of producing fluorescence; a shadow picture is shown, which he thinks proves that it was due to the fluorescence alone.

The *West. Elec.*, March 28, publishes a Roentgen photograph made by Mr. KAMMER, of a sheep's brain (which appears to have been taken through the skull); it is claimed to be an excellent production of it, but it has presumably suffered by reproduction. He is said to be an expert incandescent lamp maker, and has conducted experiments to find the best form of tube; he has reached the conclusion that American glass is far superior to the German article, and that some of his tubes worked better than the best Crookes tubes; he believes these rays will be found to exercise important functions in the chemical experiments, rendering them possible where otherwise they would have failed. The same journal states that Prof. Smith found that "re-development" seems to greatly improve the sharpness of the sciagraph.

The *Elec. Age*, March 21, reprints a short article by Mr. SANFORD, in which he describes some experiments in electro-photography in which a coin placed over a sensitive plate was put in the path of the discharge of a machine and an impression of it thereby made on the plate; he thinks the process might furnish a method of studying some of the phenomena of condensers.

El'ty, March 21, reprints a recent lecture by Mr. OSTERBERG, giving a summary of the subject; an abstract is published in the *Elec. Eng.*, March 25.

Generation of Longitudinal Waves in Ether. LORD KELVIN. *El'ty*, March 25.—A reprint of the paper abstracted in the *Digest*, March 14.

Two-Fluid Theory. E. P. THOMPSON. *Elec Eng.*, March 25.—A short article describing some experiments which he thinks favor the two-fluid theory. If a violet ray of light is passed through a fluorescent screen it is of a different color after its transit; if the fluorescent material is barium-platino-cyanide it will be green on the other side; in performing a

similar experiment with an electric spark, it appears that the spark was green only while passing through the thick screen ; if the current consist of two fluids passing in opposite directions, one would expect the violet light on both sides of the screen, while within it the color would be green ; the experiment showed this to be the case.

The Arc Phenomenon.—The *Digest*, March 7, contained an abstract of an article by Mr. Freedman describing a peculiar phenomenon in the form of a critical point at which the arc appears to become like the discharge of a Holtz machine. The discovery of this phenomenon was due to Dr. Pupin, and not to Mr. Freedman, as there stated; he also directed the experiments which were carried out by Mr. Freedman.

Spectra of the Bunsen Burner and Exhausted Bulbs. Birchmore. *Elec. Eng.*, March 25.—A reproduction of a number of different spectra of flames and vacuum tubes.

Permeability of Iron and Steel. Ostereerg. *Sch. of Mines Quart.*, Vol. 17, No. 2.—A short paper calling attention to the great value of thorough chemical analysis, and a perfect knowledge of the amount of temper of the metal; he gives the results of some investigations, which are the same as those published in The Electrical World, July 14, 1894.

ELECTRO-CHEMISTRY AND BATTERIES.

Theory of the Accumulator. Loeb. *Zeit. f. Electrochem.*, March 5.—He refers to the recently published theory of Liebenow (*Digest*, Feb. 8 and 22) and shows how he reached quite similar conclusions from an entirely different standpoint. His views differ in that he believes the function of the water, and its dissociation into hydrogen and oxygen should be given more prominence, as it makes the formation of peroxide of lead possible; the part taken by the water in the primary reactions of electrolysis, is very important; the conductivity, owing to the difficulty with which lead sulphate dissolves, is determined chiefly by the acid, that is, by the ions, which generate the acid under the dissociating influence of the water, and the water under the dissociating influence of the acid.

Zacharias Accumulator. Zeit. f. Electrochem., March 5.—Under the heading of progress in accumulators, he gives a preliminary description, without illustrations, of his new form. He considers that the destruction of the plates is due chiefly to the gases, and as the generation of gases cannot be prevented, the plates should be so made so that the gases may pass off without doing any damage; he favors plates made of paste as distinguished from those made by the Planté process; he believes that all the ingenious methods suggested for mechanically securing the active material on a grid or other form of frame, have failed, because the more securely the active mass is fastened in the metal frame the sooner and the more surely will it be destroyed. He shows how the action in large masses of active material takes place in concentric zones which then causes the matter to disintegrate; if, however, 100 needle punctures per square decimetre are made in the active material to allow the gases to escape, the result is quite different. His frame is briefly though not very clearly described; it appears that there are no metallic parts in a horizontal direction and that the frame should not prevent the expansion of the active material, that the metal frame should have numerous openings where it covers the active material, for the escape of the gases; he speaks well of the plates containing pastiles of active material except in that they retain the gases; his plates begin to gas much earlier than others, but the gas is formed in very small bubbles. Regarding the active material he states that after a year's research he finds that organic compounds of lead are the most suitable; he gives as the capacity of his accumulator about 100-ampere hours per km of active material or about 65 per km of positive plate and thinks this can still be greatly increased; the plates can be discharged at one and two amperes per square decimetre of positive active material and may even be increased to five amperes.

Nitric Acid from Air. Zeit. f. Electrochem., March 5.—A process patented by Siemens & Halske is briefly described. The process of converting the nitrogen of the air into nitric acid by means of the silent discharge is a very inefficient one; much better results are obtained when, according to the present process, the air is mixed with ammonium gas and then subjected to the "dark discharge," like in their apparatus for generating ozone; there will then be formed solid nitrate of ammonium in much larger quantities then by the usual method; care must be taken that the gases are quite dry; by properly proportioning the mixture, all the ammonium gas can be changed into ammonium nitrate; the action is increased if the air, previous to this treatment, is ozonized; a mixture which has shown good results contains 100 parts, by volume, of air, with one to two parts of ammonia; a slight excess of the ammonia does not interfere with the reaction and can be recovered.

Carbides. Moissan. *L'Ind. Elec.*, March 10.—Several Academy papers. One of them on the carbide of cerium states that this can be formed in the electric furnace; he gives its properties, one of which is that it decomposes water, forming acetylene and methane. The carbide of lithium, also produced in the electric furnace, yields with water, pure acetylene gas. Carbide of manganese gives with water a mixture of equal parts of methane and hydrogen. There is also a paper on the borides of nickel and cobalt, which have analogous properties to those of the boride of iron, which he has already described.

Chromium Amalgam. Feree. *Zeit. f. Electrochem.*, March 5.—A brief abstract from *Comptes Rendus* giving the properties of this amalgam; it is obtained by the electrolysis of a solution of 160 g. crystallized chromium chloride, 100 g. concentrated hydrochloric acid and 740 g. water, the anode being platinum and the cathode mercury, the "absolute current density" being 0.273; the heating of the amalgam in vacuum leaves metallic chromium.

Alkalies. Hargreaves. *Electrochem. Zeit.*, March.—A long description of his process. It is followed by some remarks on this process by Dr. Bein.

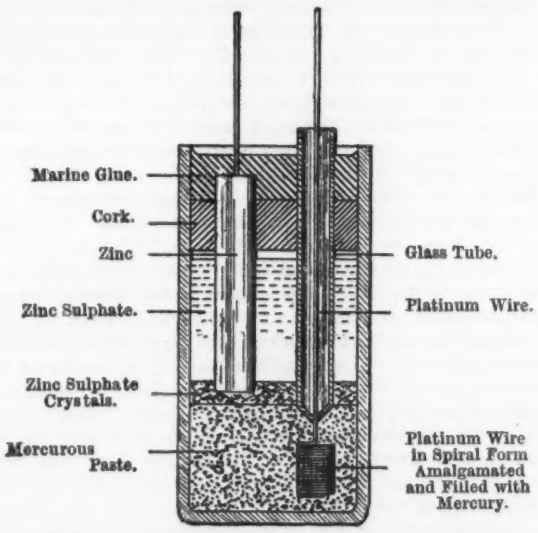
Secondary Reactions and Their Significance. Bein. *Electrochem. Zeit.*, March.—A continuation of his serial.

Modern Theories of Electrolysis. Richards. *Fr. Inst. Jour.*, March.—A reprint of a long paper read before the chemical section; he does not deal directly with the facts of electrolysis, or the verified laws of electrolysis, but with the attempts to explain the observed facts and the proven laws by postulating relations which have not yet been fully proven.

History of Electric Heating Applied to Metallurgy. Dewey. *Elec. Rev.* March 25.—A reprint of a recent paper.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Potentiometer. Fisher. Lond. *Elec.*, March 13.—A continuation of his serial (*Digest*, Feb. 22). The present portion is devoted entirely to the Clarke standard cell, on which all the measurements with the potentiometer are based; he deals with the behavior of this cell when used as a workshop standard, with all the liabilities to rough usage and careless treatment, and gives some interesting results which show that, when properly made, the cells are not nearly so delicate as is generally supposed; for practical purposes all the precautions generally adopted are unnecessary, and he claims that the more it is actually worked the more efficient and reliable it becomes; this has been proved repeatedly; a properly constructed cell may be short-circuited with a copper wire, and yet in a very short time it will return to its full value, the time being independent of the duration of the ill-treatment. He gives an illustration of the Board of Trade pattern of this cell, stating that the results are disappointing, and have been found to be so in a number of cases; a curve of the variation of 12 cells taken at random out of a batch of 50 is given, and shows very great irregularities. He gives an illustration of the Muirhead improved form of cell; the illustration, which is here produced, explains



itself; it appears that the globule of mercury is retained by surface tension; his researches, which gave such satisfactory results, were made with these cells; a number of these have been sent by mail over long distances, and none have ever been known to fail; a curve of variation of a number of these is given; as at present constructed the platinum spiral is flattened and placed at right angles with the glass tube in which it is sealed at the top as well as at the bottom; the curves show that under exceptionally trying circumstances the maximum variation between a batch of 12 cells which had been shipped to the Transvaal only amounted to 0.002 volt. A similar form to the above, intended to have a smaller internal resistance, is also shown, but the expense of it is against its universal adoption. He mentions, but does not describe, a standard cell made by Hibbert which gives just one volt; their agreement is said to be remarkably close, their temperature coefficient is negligible, their internal resistance low, and their recovery to full value requires much less time than for a Clarke cell. He describes in detail a number of experiments made to show the recovery of these Clarke cells after use and abuse, such as a short circuit; after a one-minute discharge due to a want of balance of 0.01 volt, the cell recovered completely in about 10 minutes; in another case it was connected with a low reading voltmeter and recovered in 30 minutes; after a brief short circuit it recovered in 30 minutes; after a short circuit of 20 hours it rose at first slowly and afterwards more rapidly but recovered completely in about 24 hours; 48 hours after this test the difference between this cell and another was 0.0007 volt as compared with

0.0001 before the test; this difference was recovered after a 48-hour rest; after such a long short circuit, a constant potential of 1.4 volts was applied to its terminals so as to charge it, with the result that it recovered completely in 2.5 hours; when so charged the recovery in general is very much faster. All these tests, which are but a few out of many, show that the cell can be subjected to very rough treatment; the internal resistance rises enormously on short circuit, thereby automatically cutting off the current; ordinarily they have an internal resistance of 750 ohms or less, which is at least doubled after a comparatively slight discharge, and has no tendency to increase materially after a heavy discharge; the effect of idleness is also shown; a Board of Trade cell which had been idle for several years increased in internal resistance for 10,400; a preliminary short circuit reduced it to 7,500, each subsequent discharge reducing it, which was followed by a subsequent increase; after use the cell improved; other tests showed that cells in use differ less with each other than when idle. It is thought that the potentiometer method in which there is a constant minute charge and discharge of the standard cell, is productive of good in the cells; with ordinary care it is possible to balance well within 0.0001 part of the value of the cell, as the small charges and discharges eliminate the effects of each other and as there should always be a second cell to tall back on as a check.

Measuring the Internal Resistance of Batteries. NERNST and HAAGN. *Zeit. f. Electrochem.* March 5.—A brief, illustrated description of a method for overcoming the difficulties existing in the measurement of the internal resistance of batteries with and without a current; it is a modification of the well-known Kohlrausch method, in which the source of current for a Wheatstone bridge is an induction coil, and the galvanometer is replaced by a telephone; in the present modification two arms of the bridge consist of condensers, the third arm is an adjustable resistance (which, though not so stated, should be inductionless) and the fourth, or unknown branch, is the battery to be measured; it will thus be seen that during the measurement there is no current flowing from the battery to the circuits, as it is stopped by the condensers; in order to keep the battery from sending current through the induction coil, another condenser is placed in the induction coil circuit, but its capacity need not be known; it is stated that this condenser is often quite unnecessary. When balance has been reached, that is, when the telephone gives the minimum sound, the resistance of the battery is to the adjustable resistance in the inverse proportion of the capacities of the two condensers; the ratio of these capacities is measured by the usual Wheatstone bridge and telephone in the well-known way. To measure the internal resistance while current is flowing, all that is necessary is to connect a resistance to the poles of the battery, through which it will then discharge; the measurement is then made as before, while the current is flowing, and the result obtained will be equal to the combined resistance in parallel of the cell and the external resistance, and as the latter is known the former is easily determined by calculation. A few results of measurements are given.

Clark Standard Cell.—See abstract above on "Potentiometer."

TELEGRAPHY, TELEPHONY AND SIGNALS.

Interurban Telephone Switchboard. PIERARD. *L'Elec.*, March 14.—A brief, illustrated description of the one used in Brussels and the one devised by Delville.

Line Transposition. Jour. of El'ty, February.—An article describing the experiences in and about Portland, Ore., where all the various transmission systems are in use. Grounding the cross-arms which carry a transmission circuit, thus leading the leakage to earth, did not overcome the trouble; neither did a metallic circuit; transposing the circuit every half mile showed an improvement; when the number of transpositions was increased the circuit could be used, provided there were only direct currents on the transmission line; alternating currents still proved troublesome; since then a 6-pair lead cable was placed on the pole line, the conductors being twisted in pairs; this has given perfect satisfaction; this cable is over 13 miles long. In another case a quiet line was obtained by transposing; such transpositions should be made only at such poles as are in arithematic progression; no trouble was experienced by induction from the three-phase system except when one became grounded; the impracticability of trying to offset any leakage on the transmission lines by balancing coils was also demonstrated.

Dynamo Plant for Telegraphy. Elec. Jour., March 15.—A description of the plant at the Chicago office of the Western Union Telegraph Company, which replaces 60,000 gravity cells.

MISCELLANEOUS.

Biographical. Elec. Jour., March 1.—A large full-page portrait of Wilhelm Eduard Weber. The issue of March 15 contains a full-page portrait of Carl Friederich Gauss.

Correspondence Schools. ROBERTS. *Elec. Eng.*, March 25.—A short article pointing out the advantages of a correspondence school as preparatory to resident technical schools.

Electrical Engineering at the University of Nebraska. MARTIN. *Elec. Eng.*, March 25.—An illustrated descriptive article.

New Books.

MAGNETISM. By Edwin J. Houston, Ph.D. and A. E. Kennelly, Sc.D. New York: The W. J. Johnston Company. 275 pages; 94 illustrations. Price, $1.

The introduction to this simply written and yet comprehensive little book traces the history of magnetism from the earliest days and through all of its many phases, and dwells in an interesting manner upon how the apparently feeble force of magnetism has been developed to do some of the heaviest work of the arts, the folly being pointed out of ever supposing that any physical phenomena will remain forever useless.

The first chapter takes up magnetic phenomena and illustrates and describes the elementary experiments, establishes the fundamental laws of magnetism, and clearly defines the various units of magnetic measurement. The second chapter discusses the theory of magnetism. It takes up both old and new theories, the fluid theory and the modern theories, and in simple language explains that one now most generally accepted. In the succeeding chapter the subject of magnetic circuits is treated. Numerous illustrations of flux lines from combinations of magnets and the methods of obtaining them are explained, and the physical deductions to be made from the experiments are carefully brought out. Ferric and non-ferric circuits and their usual combinations are illustrated and described. The properties of electrical helices and the subject of lines of force are thoroughly discussed, with reference to original diagrams.

Magnetic leakage is defined and practical examples are given. The resultant field from magnets in certain positions is illustrated. The next chapter, one of the most important, discusses electromagnets. Like all others, it starts from foundation principles, then gradually works up the more important applications. The effect of a wire on a suspended needle, the lines of force above a wire in a loop, coil or helix, are the subject of illustration and careful definition. An ingenious mnemonic for remembering the direction of current relative to the direction of flux is presented. Then different types of magnets are shown, with the direction of their coils indicated. The analogue of Ohm's law is shown to apply to magnets within certain limits, and these limits are clearly established. Permeability and its variable nature, with different substances and degrees of flux is also treated.

The fifth chapter relates to the attraction of magnets and the requirements for powerful magnets are enumerated. The effect of soft pole-pieces on magnets is discussed. The subjects of time required to magnetize and the effect of eddy currents form a prominent feature. Practical application is the subject of the next chapter. Telegraph, relay, telephone, electric bell, annunciator and other well-known and largely used devices are illustrated and their principles explained. Then various special devices are shown. The Edison electric pen, arc light mechanisms more or less complicated, electric gas lighting apparatus, door openers, clocks, lightning arresters and the various magnetic circuits employed on dynamos are presented as showing some of the special applications of magnetism. The next chapter is devoted to miscellaneous physical phenomena. The action of diamagnetic and paramagnetic substances, including also liquids and gases, forms the opening text of the chapter. Then the application of eddy currents in copper masses to commercial apparatus, such as to the Thomson recording wattmeter, comes under discussion. Some of the more important physical phenomena, such as the rotation of the plane of polarization, form an important closing feature. The last chapter treats of the earth's magnetism, of magnetic poles, lines and dip at various localities. Magnetic maps of the world are shown in this connection.

To those who desire an introduction to the science of magnetism this work offers an ideal medium, while the many who wish to obtain a sound knowledge of magnetic principles will find the subject treated in simple language without the employment of mathematics, and without entering into its more involved details.

LES ACCUMULATEURS ELECTRIQUES. Montage, Installation, Conduite, Entretien. Par J. A. Montpellier. Paris: A. Grelot. 224 pages, 85 illustrations. Price, 5 francs.

This brochure, by the accomplished editor of *L'Electrician*, is an elementary and practical treatise on the storage battery, intended, apparently, not for the electrical engineer, but for those in charge of an accumulator plant. It is not a descriptive work—but 10 pages being devoted to types of cells—but, as indicated in the title, relates more especially to the setting-up, care and operation of storage batteries. Considerable space, however, is devoted to the various fittings, instruments, etc., included in an installation. Judging from the character of the information and its treatment, the work is apparently a compilation from many sources, and not, like the admirable English treatise of Salomon, the result of direct practical experience.

New System of Street Car Propulsion.

A new system of street car propulsion is being tested on one of the Cleveland (Ohio) lines, and, according to information from that city, is giving very satisfactory results. The power used in propelling the car is derived from storage batteries. The car is self-contained—that is, it carries with it the electric generating apparatus, which keeps the batteries

constantly charged to their maximum capacity. A gasoline engine furnishes the power for the generation of the current. The storage batteries used in the experiments are those of the Ohio Storage Battery Company, 52 Wade Building, Cleveland. Mr. Washburn is the inventor of this battery, as well as the motor used on this experimental car. Mr. J. J. Shipherd, a well-known electric railway man in the West, is interested in these experiments, and looks upon the system with considerable favor.

A Kerosene Torch.

In these days of rapid improvements and push the daylight period is not long enough to enable contractors to keep up with their work, and in many cases night work is resorted to. This is especially true in large building operations and in the laying and repairing of street railway

Torch for Night Work.

tracks. Night work necessarily requires some powerful artificial illumination, and many devices have been brought out for the purpose.

The "Wells Light" of William Halpin, 44 and 46 Washington Street, New York, has met with considerable favor for outdoor night work, on account of its portability, powerful light and general efficiency.

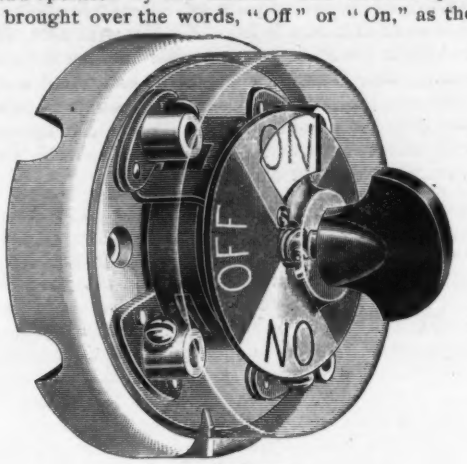
The apparatus used is very simple and strong, and the light is steady and continuous and unaffected by weather conditions. The lights are worked by means of compressed air, which forces the oil to a burner, where it is heated and vaporized, producing a flame giving from 800 to 2000 candle-power, according to the size of the burner used. The burner generates the gas continuously from the ascending oil, which is under pressure. The tanks are made of best galvanized steel plate, and are very strong.

This light is in constant use by contractors, and also by life saving and light house departments of the United States Government. It was used at the new dry dock at the Brooklyn Navy-Yard, and was recently employed by Mr. Lemuel W. Serrell at Camden to lay a section of track during the night in order to evade an injunction.

Indicating Switch.

A new dial switch, which indicates whether the current is turned off or on, and of which we give an illustration herewith, is being placed upon the market by the Perkins Switch Manufacturing Company, of Hartford, Conn.

The chief feature of this switch is the dial, which is attached to the mechanism and operated by the handle. The dial has upon one side a slot which is brought over the words, "Off" or "On," as the handle is



Dial Switch.

turned. The switches are made in various sizes, for currents of from 5 to 50 amperes, and voltages as high as 500. They are especially adapted for use where there is no expert attendance, as with electric heaters, and especially for street railway heaters, the type for the latter being designed for 10 amperes at 500 volts.

The switches are made in single-pole, double-pole and three-point designs.

A Combined Electric and Pumping Turbine Plant.

The accompanying engraving illustrates a special water power plant constructed by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, O., for the Consolidated Canal Company, at Mesa, Ariz. The water is taken from the Salt River and carried by a 48-inch feed pipe across the Utah canal to a pair of 21-inch cylinder gate "Victor" turbines on a horizontal shaft developing 400 horse-power under a head of 40 feet. One end of the shaft is connected by friction clutch to a 200-hp dynamo, which furnishes light and power for the town of Mesa. The other end of the shaft is connected to a pumping plant for irrigating purposes.

A Western Water-Power Plant.

A Southern Telephone Exchange.

We give herewith two illustrations of the new exchange of the Peoples Telephone & Telegraph Company, of Knoxville, Tenn., of which Mr. J. C. Duncan is general manager, and which is claimed to infringe no patents held by the Bell Company. Fig. 1 gives a view of the switchboard in

FIG. 1.—VIEW IN DAYTIME.

daylight, and Fig. 2 a view taken at night. At present there are 600 numbers in use, with 400 numbers in reserve, to be connected up as they are needed. The present arrangement has a cord for each number, but is now being changed so that there will be but 20 cords to each section of 100 for closing out drops. For all short lines the Blake transmitter is

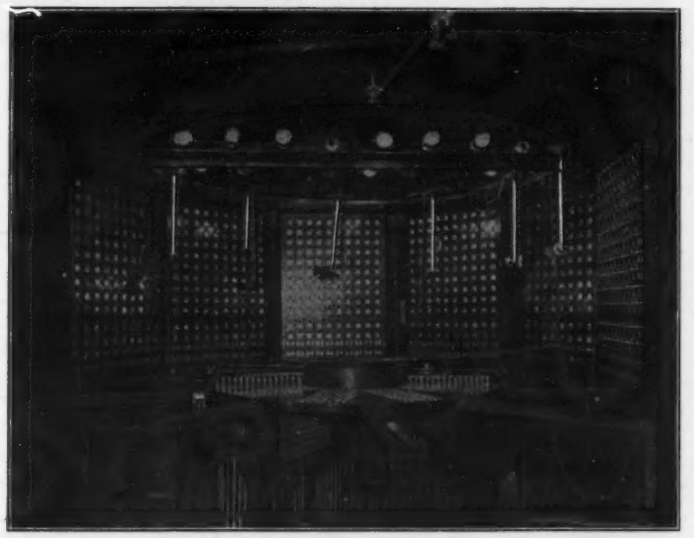
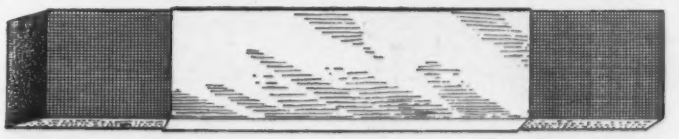


FIG. 2.—VIEW AT NIGHT.

used without the hinge connection; all unexpired patents and switches, it is claimed, have been avoided. The rates of this company, which is in competition with the Knoxville Bell Company, are $30 and $24. We are informed that at the end of the year, in February, the balance sheet showed $10,000 over and above running expenses of all kinds.

Ventilated Dynamo Brush.

The accompanying illustration shows a dynamo brush, manufactured by Younglove & Gere, Syracuse, N. Y., which is designed to provide self-ventilation, thus avoiding the consequences of heat in the brush.



GAUZE DYNAMO BRUSH.

It is manufactured from copper wire gauze of the highest conductivity, and the meshes, which are of uniform size, run both lengthwise and crosswise, thus preventing spreading or bursting. It is provided with an adjustable shield, which keeps the brush in perfect form and at the same time permits of its being used up to a very short length.

The advantages claimed for this brush are the absence of sparking and heat, and that it does not cut or in any way damage the commutator. It possesses sufficient elasticity to ensure good and easy work and is at once durable, efficient and simple. The brush being soft and pliable reduces the friction on the commutator to a minimum, and its use is claimed to ensure a steady current and consequently a steady light. These ventilated brushes are suitable for all classes of electric generators, also for railway and power motors.

The Hunt Coupling for Transmission Rope.

The rapid increase in the transmission of power by rope has made prominent one of the minor difficulties attending its use. This is the gradual lengthening of the rope, which increases the sag until it becomes

FIG. 1.—COUPLING BEFORE BEING ADJUSTED ON THE PULLEYS.

necessary either to resplice the rope or to use a take-up sheave with a very long range of motion. Rapid wear of the rope from slipping on the pulleys is frequently caused by lack of sufficient tension.

The Hunt rope coupling which we illustrate, made by the C. W. Hunt Company, 45 Broadway, New York, is designed to do away with all necessity for resplicing, etc., as it will keep a rope at exactly the right tension for the most effective service and long life, and do this with little or no extra time or attention being given the matter and with no expense other than the first cost of the coupling. The device is made wholly of aluminum bronze and has a tensile breaking strength of 60,000 pounds to the square inch and an elongation of 20 per cent. in eight inches, which is equal to the strength and toughness of mild steel. It is very simple in its construction, there being but two parts, consisting of a screw and socket. These screw together when the rope is first put on the pulleys and lock securely, so that the coupling can be separated only by using a wrench of special design.

A very important and interesting feature of the coupling when screwed together is an internal swivel and ratchet, which we show in Fig. 3. The swivel permits the joint to yield to the curvature of the pulleys while the

FIG. 2.—COUPLING MOUNTED IN THE DRIVE.

ratchet holds the parts from revolving on each other and untwisting the rope.

The Hunt coupling is made smaller in diameter that the rope with which it is to be used, in order that it may not touch the grooves of the pulleys, even when the rope is worn.

The rope of the correct length for the drive when connected up is spliced into the coupling, and as it wears longer more "turns" are put into it by revolving one part of the coupling, the ratchet automatically holding all secure when the rope has the proper length and tension.

Where several independent ropes are run side by side on a pulley all

FIG. 3.—SWIVEL AND RATCHET.

can be kept at the same tension with the greatest exactness by putting a few more turns in the slack one when such a condition is noticed. By using this coupling, in a multiple rope drive, any single rope can be taken off in a few minutes, and the work done by the remaining ones until it is convenient to put on a new rope, which can be done with equal dispatch, and, what is of greater importance, the tension adjusted to correspond exactly with the other ropes. The cost of a rope drive, with this coupling spliced in and installed in position on the pulleys, is usually less than that of ropes spliced in the ordinary manner, and it is also less than a rope drive with a tension pulley, which, in addition to its cost, frequently requires to be spliced two or three times during its life, while the couplings having no wear, are permanent, with no further expense after once installed, it will be seen that this method is much the cheaper, as well as the better one.

The advantages, both in the convenience of installation, the facility of adjustment of tension, the perfect control of the sag and the increased life of the rope from a more equal tension, are sufficient to justify an expenditure of many times their cost.

Ceiling Fan Motor.

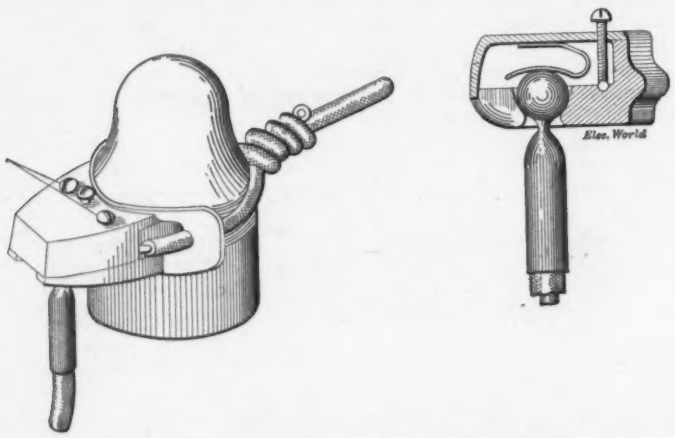
We illustrate herewith a new ceiling fan motor made by the Interior Conduit & Insulation Company, 527 West Thirty-fourth Street, New York, which has been named the "White-Wings." Owing to the little

Ceiling Fan Motor.

height taken, it is especially adapted for low studded ceilings, and its form is such as to give a presentable appearance. The blades are of aluminum—which accounts for the name.

McGill Connector.

Every arc light circuit, however well built, always possesses the element of uncertainty as to its continuity, and almost every station manager has experienced the annoyance attending the accidental opening



Figs. 1 and 2.—Connector for Arc Circuits.

of a circuit. In spite of the utmost precautions such circuits will open once in a while, and always just at the most inopportune time.

The weak points of an arc light circuit are at the connections between the line wires and lamp loops, and at cut-out connections, and much trouble is caused sometimes by the failure of these connections.

Appreciating the difficulties of this nature, Mr. John J. McGill, of Thorold, Ont., has invented a connector which is designed to prevent open circuits on arc lines where the wires loop down to lamps. It is also intended to take the place of unreliable cut-outs, many of which are met with in practice.

The connector, which is about to be put upon the market by McGill & Battle, of Thorold, Ont., is shown in two different aspects in the accompanying illustration, Fig. 1 giving a perspective view of the connector and its application to an insulator, and Fig. 2 a longitudinal section view of the connector, showing the most important details of construction.

The cap of the connector (Fig. 2) is removable, and held in position by two screws. In order to make a lamp connection the cap is first removed and the line wire brought around the insulator and through the interior of the connector, and then wrapped around itself as shown in Fig. 1.

The wire inside of the connector is bared of a sufficient length of its insulation to ensure contact with the metal base by being held in place in the groove by a set screw, shown in Fig. 2.

The lamp connection is effected by means of a ball-and-socket joint, shown in Fig. 2, the lamp wire being connected to the pendant metal lug on the interior of the latter.

A spring attached to the under surface of the connector-cap presses upon the ball and keeps it in place in the socket, thus insuring a large contact surface and freedom of motion of the wire.

It is evident that this ball-and-socket feature admits of the swaying of the loop wires in any direction, without impairing the electrical connection with the main line.

These connectors have been subjected to severe tests, and are reported to have proven satisfactory in every way.

They are about to be placed upon the market by McGill & Battle, of Thorold, Ont.

A New Turret.

We illustrate herewith a new style turret now being introduced by the Davis & Egan Machine Tool Company, of Cincinnati, O. We show the turret with its upper and lower portions separated, and also mounted for use upon the carriage of a 36-inch lathe. Its principal difference from the usual form of turret is an extension at the base, provided with a T-slot, in which can be placed tool posts of the ordinary form, so that, in addition to the usual tools held in the turret holes, ordinary forged lathe tools can be adjusted in this slot, as many being used as may be needed. A cut-off rest can also be used on the turret by attachment to this slot, and such a rest is shown at the left of the dismembered turret.

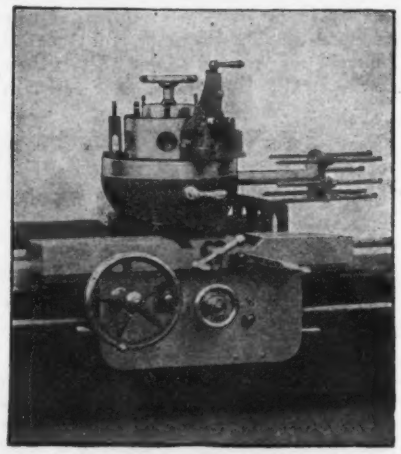


Fig. 1.—Turret Mounted on 36-Inch Lathe.

There is a separate stop-screw for each tool, each one being independently adjustable for its particular tool, thus doing away with the necessity for separate adjustment of each tool to precise position. For facing cuts a turret and an ordinary post-held tool can be used simultaneously—one for roughing and the other for finishing. In the case of the particular turret shown, three-inch stock can be passed through the stem. Ten different sizes are made, and they are used either on lathe carriages or on regular turret slides, and revolve automatically or otherwise. Work may be done by this turret without the use of box tools through a wide range of work, including all the work usually attempted on turret machines.

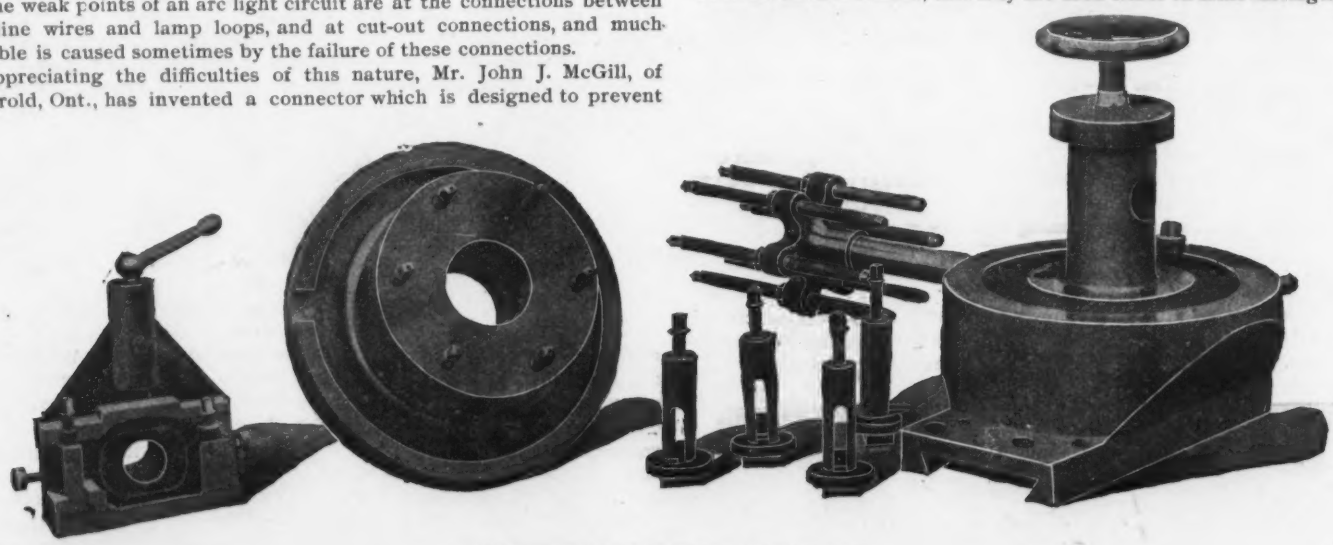


Fig. 2.—Lathe Turret Unmounted.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, March 28, 1896.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of New York, has declared a quarterly dividend of 1½ per cent., payable May 1.

THE GENERAL ELECTRIC-WESTINGHOUSE DEAL.—It is reported that the patent agreement between the General Electric and Westinghouse Companies will be put in force on June 1 next. The commission that is to have charge of the matters involving the use of the patents concerned has not yet been appointed.

MEXICAN TELEGRAPH COMPANY has declared a quarterly dividend of 2½ per cent., payable on April 16.

THE ELECTRIC STORAGE BATTERY COMPANY, it is claimed, is doing such a large business that dividends on both common and preferred stocks are expected. In Philadelphia, it is reported, sentiment in favor of this stock is growing more and more favorable.

AMERICAN ELECTRIC HEATING CORPORATION.—Announcement was made this week of the consummation of the consolidation of the various electric heating companies under the name of the American Electric Heating Corporation of Boston. The capital stock of the new company is $10,000,000 (par $50), and an issue will be made of $500,000 15 years 5 per cent. income bonds. Of these securities $8,900,000 stock, and $269,000 bonds will be used to buy up 13 electric heating companies, having a capital of $6,715,000. All patents, processes and devices throughout the country that are believed to be of value will be purchased. One million and sixty thousand dollars stock, and $231,000 income bonds will be left in the treasury for future needs. The bonds will be cumulative after Jan. 1, 1898, and are to have a sinking fund of $10,000 per annum.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	96	98½
" " " Brooklyn	100	100	102½
" " " Boston	100	135	140
" " " Philadelphia	100	131	131¼
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	26¼	26½
Electric Storage, pref	100	27½	28
General Electric	100	35½	35⅝
General Electric, pref	100	67	70
Westinghouse Consolidated, com	50	29	31
" " pref	50	52¾	54

BONDS.

Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	200	202
American District Telegraph	100	33	40
American Telegraph & Cable	100	91	94
Central & South American Telegraph	100	124	147
Commercial Cables	100	157	..
Erie Telephone	100	59	59½
New England Telephone	100	88½	89
Postal Telegraph-Cable	100	86	..
Western Union Telegraph	100	83¼	83⅜

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	17⅛	17¼
Brooklyn Rapid Transit		20½	21
Brooklyn Traction	100	10½	19
" " pref	100	46	48
Buffalo St. Ry	100	72	74
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	47	50
Hestonville	100	47	..
" pref		..	62
New Orleans Traction	100	17	19
" " pref	100	63	66
North Shore Traction	100	28	31
" " pref	100	77	80
Rochester St. Ry		28	33
Steinway, Ry		45	50
Union Railway (Huckleberry)		98	.
Union Traction, rcts $10 pd		15	15½
West End, Boston	100	67	68
" " pref	100	88	90
Worcester Traction	100	15½	17
" " pref	100	87	90

BONDS.

Brooklyn Rapid Transit 5s, 1945	100	79	81
Buffalo St. Ry. 1st con. 5s	100	104¾	..
Cleveland Elec. Ry. 1st mtge 5s	100	101	103½
*Columbus St. Ry. 1st 5s	100	111	112
Rochester St. Ry. 1st 5s	100	98	101
Union Railway (Huckleberry) 1st mtge 5s		103	105½
*Westchester Electric 1st mtge 5s	100	100	102

* With accrued interest.

THE EARNINGS of the Central & South American Telegraph Company for the quarter ending March 31 are estimated at $231,477, from which a quarterly dividend of 1¾ per cent. has been declared, payable April 9.

TRACTIONS.—The Metropolitan Traction Company has declared a quarterly dividend of 1¼ per cent., payable April 15. The New Orleans Traction Railway reports gross earnings for February of $115,325, an increase of $27,814 as compared with the same month of last year, and net $56,069, an increase of $21,694.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, March 30, 1896.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK has issued invitations to a reception to be held at its general offices on Duane Street on April 2. The Duane Street station will be open for inspection.

CHARLES A. SCHIEREN & CO., 45 Ferry Street, report a good business in their oak bark tanned leather belting. Among recent sales are the following: a 64-inch three-ply belt for the United Electric Light Company, Springfield, Mass., also a 52-inch double belt for the Omaha Street Railway Company, Omaha, Neb.

THE NEW YORK ELECTRO-THERAPEUTIC CLINIC LABORATORY AND DISPENSARY will celebrate its first anniversary by an informal reception at 327 East Twenty-fifth Street, at 8 o'clock on the evening of April 6. A report of the year's work will be submitted. Dr. Margaret Cleaves is secretary.

J. STANFORD BROWN, the well-known electrical engineer, is vice-president of the Mutual Realty & Loan Corporation, which has its offices in the American Surety Building, 100 Broadway. According to the last report, the company is on the high road to prosperity, and Mr. Brown's friends wish him success in his new field.

THE DAVIS & EGAN MACHINE TOOL COMPANY, of Cincinnati, O., has just completed a large shipment of tools to its new store at 107 Liberty Street, and will make another large shipment this week. Its new store is much finer and larger than the old one, enabling it to carry a very large stock of its latest improved machine tools.

THE COMPLETE ELECTRIC CONSTRUCTION COMPANY, 121 Liberty Street, was placed in the hands of a receiver on March 25. The company was organized in 1888 under the New Jersey laws, with a capital stock of $50,000. Mr Charles Haldane Johnson was appointed receiver. It is stated that the company's suspension is due to the lack of funds. Its liabilities are reported to be $66,902; nominal assets, $102,000.

MESSRS. W. R. FLEMING & Co., 203 Broadway, recently closed a nice order for the engines used in the electrical plant of the American Surety Company's new building at Pine Street and Broadway, New York. The engines are of the well-known make of the Harrisburg Foundry & Machine Company, for which Messrs. Fleming & Co. are New York agents. A highly interesting technical description of this plant will be found elsewhere in this issue.

McLEOD, WARD & CO., Thames Building, are meeting with a brisk demand for their Kinsman desk lights and portables. They have appointed as wholesale agents for their goods the following named well-known firms: Central Electric Company, Chicago; McKenney & Waterbury, Boston, Mass. Thos. Day & Co., San Francisco, Cal.; and W. H. Glenny, Sons & Co, Buffalo, N.Y. McLeod, Ward & Co. also manufacture chain spark arresters and other arc lamp specialties suitable for any make of arc lamp.

THE BENEDICT & BURNHAM MANUFACTURING COMPANY, 13 Murray Street, will move about May 1 into handsomely fitted-up offices on the second floor of the Postal Telegraph Building. The new offices face on Murray Street and have an abundance of light. The company will dispose of its stock of goods which it now carries at its present quarters, and will not carry any more goods in New York after it moves into the new offices. All shipments of goods will be made from the factories in Waterbury, Conn.

MR. EDWIN S. REID, who has been with the Standard Underground Cable Company for many years, as superintendent of construction, has severed his connection with that company and has accepted a position with the National Underground Cable Company, as its general superintendent of construction, and all construction work done by the National Company will be under his immediate charge and supervision. Mr. Reid, who was for many years associated with Mr. Stephen D. Field, in his various electrical enterprises, entered the underground cable business in its earliest days, and many of the appliances used on underground cable work, which have tended to make underground cables successful, are of his invention and design. The well-known Reid cable terminal, which was invented by him only a few years ago, has given such satisfaction and met the requirements of the users so well, that over 100,000 of them are in use to-day in the United States and Canada on telephone, telegraph and electric light cables for underground and aerial service. There are but few underground systems in the United States which Mr. Reid has not had something to do with, and his experience covers not only the construction of cables, but also the building of complete subway systems and besides he has the advantage of being able to make the most delicate and

complicated electrical tests, and of being master of electrical subjects generally. Mr. Reid has already started in on his work with the National Underground Cable Company.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., March 27, 1896.

MR. GEO. F. PORTER, secretary of the National Electrical Light Association, was a recent visitor to Boston.

THE BROCKTON ELECTRIC MANUFACTURING COMPANY, Brockton, Mass., is doing an excellent business in its specialty of leather nail heads, originated and first introduced to the electrical trade some years ago by its manager, Mr. J. N. Wentworth, and for which in the fastening of porcelain cleats and insulators there has always been a good demand. The company is now prepared to fill orders quickly and at reduced prices.

THE NEW ENGLAND ELECTRICAL TRADES ASSOCIATION held a meeting recently, and the following named officers were elected for the ensuing year: President, Frank Ridlon; vice-president, Elbert Wheeler; treasurer, Walter S. Barker; secretary, Frederick W. Brown; Executive Committee, D. A. Andrews, Arthur Drew, Philip M. Reynolds, C. C. Allen and Henry B. Cram. Steps were taken to incorporate this organization under the laws of Massachusetts.

THE ELECTRIC STORAGE SUPPLY COMPANY, 95 Summer Street, Boston, is the name of a corporation that is doing a splendid business in storage batteries of all kinds. Not only does this company contract for the installation of storage batteries, lighting plants on yachts, private residences or public buildings, but it owns and operates the most modern apparatus for repairing or recharging all types of batteries. Old batteries are also purchased or exchanged. Mr. F. H. Speed, general manager, has had a long and varied experience in battery work.

THE AMERICAN TOOL & MACHINE COMPANY, 302 Federal Street, Boston, Mass., is pushing its special designs in improved stands for quarter turn belts under all conditions. It also has some very unique designs in belt tighteners, calculated for very heavy belts. The adjustment of these tighteners are absolutely perfect, and will meet all cases. It also has a large line of special stands fitted with self-oiling appliances. These stands are, of course, intended for heavy line shafting for electrical and mill work. The trade is so thoroughly familiar with the complete line of friction clutches, special couplings, etc., carried by this company, that it is not necessary to give them special mention.

THE ANCHOR ELECTRIC COMPANY, Boston, makes an excellent showing for its year recently closed, and a handsome dividend on the capital stock has been earned, a fact which places it in the ranks with the few exceptional corporations earning dividends in these times of depression and sharp business competition. The Anchor Company differs from the average electrical supply establishment in that it is a large manufacturer of electrical specialties as well as dealer, which is, of course, greatly in its favor, but which fact alone does not account so much for its prosperity as does the excellent business ability of its management, President H. C. Hawks, Vice-President Norman Marshall and Treasurer P. M. Reynolds, and an able corps of territorial representatives and salesmen.

MR. SUEL SMITH, who recently died very suddenly, had been in continuous service as a telegrapher for 46 years, and was the oldest active operator in the country. In fact, his connection with telegraphy is almost as old as the system itself, for his service dated back until within six years of the advent of the first experimental line between Baltimore and Washington. At the time of his death he was the Boston agent of the Gold & Stock Telegraph Company, and had held this position since 1871. Few men were more widely known or highly respected than was Mr. Smith, and his death occasions sincere regret among his friends, who were legion, and who will sadly miss his sterling qualities of art and mind, geniality, and apparently inexhaustible humor, which made him always the attraction in many a circle.

W. D. HOFFMAN & CO., 628 Atlantic Avenue, have sold 1500 horse-power in Slater slow-speed and Dick & Church high-speed engines during the month of March. The 350-hp single cylinder non-condensing Slater engine, at the Peabody Electric Light Company plant, started in December, 1895, is doing excellent work. The safety device attached to all engines of the Slater type sold by W. D. Hoffman & Co., has proved itself to be absolutely operative under all conditions where accidents are liable to occur from an excess of speed. The Messrs. Hoffman have lately taken the contract for the steam plant for the Warren & Brookfield Street Railway Company, and will furnish engines, boilers, piping, boiler settings and engine foundations, also a 325-hp vertical Slater engine to Messrs. Dean & Main for Kuhnhardt & Co.'s mill at Lawrence, Mass. Patterns for a number of special strokes for Slater vertical engines are nearly completed, ranging in power from 250 to 2500 and in speed from 80 to 130 revolutions per minute. The Slater releasing valve motion runs successfully at 135 revolutions per minute, and is consequently especially adapted to the direct coupled system in electrical work, and any special cases in directing, connecting to line shafts, rolling mill service, etc.

L. A. CHASE & Co. (Incorporated), 161 Fort Hill Square, Boston, well and favorably known for electrical manufacturing and repair work, now occupy three floors of the building in which they are located. The executive offices are located on the second floor. Only a short time ago the business was confined to less than one floor. This expansion evidences in a decided manner the result of the well-directed energy of Mr. S. B. Condit, its manager. Mr. Condit, while comparatively young in years, has had a large experience in the electrical line, having been previously connected with the C. & C. Motor Company, Stone & Webster and the Shawmut Fuse Wire Company, gaining thereby an intimate knowledge of electrical apparatus. This fact, together with his pushing business qualities, has brought the Chase Company to its present successful position. Another valuable acquisition to the company was recently made through the connection with it of Mr. Chas. E. Sprague as treasurer, who is a thorough business man of varied experience and training. The new catalogue of this company just issued is a little "gem," and briefly presents its claims and facilities, interspersed with handsome views of its factory, which is equipped with the best modern machinery for all classes of repairs to dynamos, motors and other electrical apparatus by skilled workmen. Special attention is given to the rewinding of armatures, and its testing department is thoroughly equipped with the most modern instruments for testing all kinds of electrical work. The company is also agent for the Forest City Electric Works, the Bergman Arc Lamp and the Turner Brass Works, the manufacture of all of which are incidental to the Chase Company's special lines.

Philadelphia Notes.

Branch Office of The Electrical World,
927 Chestnut Street,
Philadelphia, Pa., March 28, 1896.

GEORGE W. DERBYSHIRE, successor to Derbyshire & Reed, electrical and scientific instruments, has moved from 3217 Kensington Avenue to 2739 Ann Street.

THE CLEVERLY ELECTRIC WORKS, 1018 Chestnut Street, were partially destroyed by fire on March 18, entailing a loss of $3000. Mr. Cleverly states, however, that he is in a position to handle all orders promptly.

MR. JOS. PRICE BALL, Station F., manufacturer of switches and switchboards, reports that business was never better with him. Mr. Ball claims to make a very superior switch for less money than it can be bought elsewhere.

THE THACKARA MANUFACTURING COMPANY, whose factory and store were destroyed by fire on March 19, have opened temporary quarters in the Baker Building, and expect to have their factory in full operation in about three weeks.

FRANK H. STEWART & CO., 35 North Seventh Street, manufacturers of Stewart's incandescent lamps and electrical supplies, have just issued a neat price list, consisting of 16 pages, which will be sent free upon application to those desiring it.

J. ELLIOTT SHAW & CO., 632 Arch Street, manufacturer of and dealer in electrical supplies, is making a specialty of white flint jars, known as Shaw Grenet cells, French form, which are beautiful in appearance, made of the hardest carbons procurable, large zinc amalgamated metal parts, polished brass, lacquered, and are sold for about one third the price of those imported. They have recently issued a very nice catalogue, which will be sent free upon application.

Washington Notes.

Washington, D. C., March 27, 1896.

EMILE BERLINER, of Washington, D. C., has sold his patent dated Aug. 10, 1886, relating to the manufacture of carbons, to the New York Carbon Works, of New York City.

THE TREASURY DEPARTMENT has awarded contract for one electric passenger elevator, including car, etc., to the Sulzer-Vogt Machine Company, of Louisville, Ky., for $2,945.

THE JOINT RESOLUTION authorizing the Secretary of the Treasury to distribute the medals and diplomas awarded by the World's Fair Columbian Commission to the exhibitors entitled thereto has been signed by the President.

A CAR of the Washington & Fort Myer Electric Railway left the track a morning or two ago near Rosslyn, and rolled down a 15-foot embankment. The car contained four persons, but only one of them was seriously injured. As it was drill day at Fort Meyer the company had put on extra cars in anticipation of a large business. The officers of the road, which has been recently placed in operation, say that the breaking of an axle of the trailer car caused the accident.

THE MACHINERY at the new power-house of the Washington, Alexandria & Mount Vernon Electric Railway, near Four Mile Run, which is to operate the Arlington, Washington and Alexandria lines of the company, is now all in position and fires have been started in the boilers and steam generated to give a working test to the machinery. The dynamos and engines in the power-house are among the largest in the country, and will supply the current necessary to drive the big cars between Alexandria and Washington at a speed of about 45 miles an hour.

IN THE MATTER of the protest of Columbia College against the decision of the Collector of Customs at New York as to the rates and amount of duties charged on two standard ohms, one standard resistance, one alternating-current wattmeter, one Siemens' wattmeter, all of which, it is claimed, are entitled to free admission under paragraph 677, act of October, 1890, the United States General Appraisers of the Treasury Department find that the articles are scientific apparatus or instruments not intended for sale, and specially imported in good faith for the use of Columbia College. The protest is sustained accordingly.

Western Notes.

Branch Office of The Electrical World,
936 Monadnock Building,
Chicago, Ill., March 26, 1896.

THE INDEPENDENT ELECTRIC COMPANY has removed its office and salesroom from Thirty-ninth Street and Stewart Avenue to 153 Lake Street.

MR. T. G. GORDON, the well-known representative from the J. A. Roebling Sons' Company, was to be seen hustling around Chicago last Saturday. He reported business first class with them. This cannot be wondered at with such a popular worker as Mr. Gordon on the hustle.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has just completed the installation of an electric light and power plant in their own building at 242 Madison Street. The power is secured from a natural gas engine, which also does the work of driving a large freight elevator. The plant is running nicely and producing a satisfactory light. It is needless to say that the

dynamo is splendidly assisted in accomplishing its results by the use of Paranite wire and Packard lamps. The switchboard is equipped with C. E. M. Jack Knife switches and Whitney instruments.

UNIVERSITY OF WISCONSIN ANNUAL INSPECTION TRIP.—The junior class of electrical engineers of the University of Wisconsin will leave Madison Monday morning, March 30, on its annual inspection trip. Monday afternoon will be passed in a visit to the works of the Gibbs Electric Company and incandescent lamp factory at Milwaukee. On Tuesday morning the engine works of E. P. Allis & Co. will be visited, and either the Pabst or Schlitz Brewing Company's plant. On Wednesday morning the Washington Street station of the Chicago Edison Company and either their Harrison Street station or the electric plant at the Auditorium will be inspected, and the afternoon will be passed at the works of the Siemens & Halske Electric Company. On Thursday the Pullman and the Illinois Steel Works, South Chicago, will be visited, and in the afternoon the Western Electric Company's plant Friday afternoon will be spent at Fraser & Chalmer's machine shops and bicycle factory. Arrangements will probably be made for Saturday morning, after which the party will disband. The electrical engineering students are not obliged to follow the program as given above, but are entirely free to substitute at any time the program as arranged by the departments of machine design, mechanical or civil engineering.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, March 18, 1896.

GOVERNMENT AND THE TELEPHONES.—It is definitely announced that the Post-office will take over the trunk wires of the National Telephone Company on April 4. This is about the third date which has been given for this event.

FIRES AT CENTRAL STATIONS.—The ill luck in the matter of fires in London central stations still continues. On Saturday night last the battery room of the Crystal Palace District Electric Supply Company caught fire, and serious damage ensued. The insurance companies have already doubled their rates, perhaps now they will treble them.

MUNICIPAL PURCHASE OF ELECTRIC LIGHT UNDERTAKINGS.—English municipalities appear determined, when they have not been sufficiently enterprising to embark upon the business of electric supply, to purchase, out of hand, companies which have set up within their jurisdiction. As I stated some months ago, the Liverpool Corporation, after having allowed the Liverpool Electric Supply Company to build up a magnificent business under a three-wire system, suddenly decided that this could no longer be permitted, and agreed to buy out the company for the handsome sum of about one quarter of a million sterling, and but for the formality of parliamentary assent, this transfer is now complete. A more recent instance is Southampton. The electric light undertaking in this rising seaport has not attained such large dimensions as that of Liverpool, and it will, in all probability, be bought out by the municipality for the modest sum of £21,000.

General News.

NEW INCORPORATIONS.

THE ROSLYN ELECTRIC LIGHT COMPANY, Roslyn, Wash., has been incorporated with a capital stock of $10,000. The incorporators are D. Thiery and L. E. Salladay.

THE HAMBURG ELECTRIC LIGHT COMPANY, Hamburg, Ia., has been formed with a capital stock, of $12,000. The incorporators are W. S. Staley, C. D Butterfield, C. A. Buckmaster and H. T. Hays.

THE GRANT COUNTY TELEPHONE COMPANY, Bloomington, Wis., has been organized with a capital stock of $10,000. The incorporators are G. A. Marlow, Grace A Marlow and L. D. Holford.

THE FRIENDSHIP ELECTRICAL COMPANY, Friendship, N. Y., has been incorporated with a capital stock of $5000. The directors are H. E. Corbin, B. J. Rice and A. M. Wellman, of Friendship.

TELEGRAPH AND TELEPHONE.

CASPER, WYO.—Casper is to have a telephone exchange.

SHELDON, IA.—A new telephone company has been organized in this place.

NEW LONDON, N. H.—A telephone line between this place and Bradford is projected.

BURLINGTON, VT.—A telephone line between this city and Hinesburgh is contemplated.

QUINCY, ILL.—A telephone line is to be established between this city and Hannibal, *via* Payson.

DOVER, DEL.—The Dover Telephone Company has extended its lines to Milford and Georgetown.

DECATUR, IND.—The Citizens Telephone Company will build separate lines to Monroe, Berne and Geneva.

BLANCHARD, IA.—There is talk of a telephone line being run from Blanchard to Tarkio *via* Northboro.

FENTON, MICH.—A stock company is being formed at Fenton, for the purpose of establishing a telephone exchange.

HONESDALE, PA.—The Delaware & Hudson Canal Company is constructing a telephone line between Honesdale and Carbondale.

BELLAIRE, O.—The Central District Telephone Company has been granted permission for the location of its poles in the streets of this city.

PRINCETON, MO.—A telephone line will be built from this place to Haw, which will secure connection between Princeton, Ravanna and Mercer.

TAYLORSVILLE, KY.—A telephone line will be built from this point to Fisherville, Wilsonville and Elk Creek. It is to be completed in 90 days

ST. AUGUSTINE, FLA.—The City Council has granted a franchise to George F. Shaver to erect lines and conduct a telephone system in this city.

GIRARD, O.—The Central District & Printing Company has secured a telephone franchise in this place, and construction work will be commenced at once.

CAPE MAY, N. J.—The Delaware & Atlantic Telegraph & Telephone Company will construct a telephone line from this city to Bridgeton, N. J. Work will begin soon.

PHILADELPHIA, PA.—The Select Council has granted permission to the Philadelphia Standard Telephone & Telegraph Company to establish a telephone system in this city.

ROCHELLE, ILL.—The council has granted a franchise to Otto Wettenstein, Jr., to establish a telephone exchange in this place. He will effect connection with various places in this section.

IRVINGTON, N. Y.—The Board of Trustees has granted a franchise to the Westchester County Telephone Company, for the purpose of erecting poles and stringing wires in the streets of that village.

DEADWOOD, S. D.—George Cornwall and others have been granted a franchise for a telephone exchange and system in this city. The lines will be extended to several places in the Bald Mountain country.

MINNEAPOLIS, MINN.—The Northwestern Telephone Exchange Company will extend its Albert Lea line to Wells, where connection will be made with Winnebago City, Blue Earth City and other places in that vicinity.

MT. CARMEL, PA.—Among the provisions of the franchise recently granted to the Shamokin Valley Telephone Company, by the Mt. Carmel Borough Council, is a clause making it obligatory upon the company to pay a yearly rental of 50 cents on each pole set within the borough limits.

ALAMEDA, CAL.—Many telephone subscribers in this place not taking kindly to the nickle-in-the-slot device in connection with their telephones, have notified the Sunset Telephone Company to take out the nickel-in-the-slot machines or the telephones. The company refuses to take out the slot machines.

ATLANTA, GA.—Opelika, Ala., is now connected with this city telephonically. The Harrison International Telephone Company are making arrangements to open an exchange in this city, and it is reported that they have already secured about 1000 subscribers. The new company proposes to cut the present telephone tariff in two.

THE POSTAL TELEGRAPH COMPANY, according to a statement just issued, has a pole mileage 10 per cent. that of the Western Union Company, and 14.6 per cent. of wire mileage. The company has earned dividends for several years, but has applied the money to the extension of its system, issuing stock from time to time to pay for the important extensions south and southwest. The postal lines now practically reach all important paying points in the United States. Its system is modern in every respect.

THE SUNSET TELEPHONE COMPANY, of San Francisco, has decided, for educational and advertising purposes, to issue 1,000 telephone sets at 50 cents per month, to be used in kitchens of private residences. These telephones are for outward services only, and can be readily used to send word to the physician, druggist, butcher, grocer, coal dealer, etc. There will be no arrangements made at these telephones for being called up, and the company will thus save expense in the central office, in order to be able to give such convenient telephone service at such low rates. This service includes metallic circuit, Blake transmitter, express service and unlimited use. By unlimited use, the company means the full capacity of the circuit with which the different telephones are connected.

ELECTRIC LIGHT AND POWER.

NEW ALBIN, IA.—An electric light plant will probably soon be established in this place.

LEON, IA.—The citizens of this place, by a large majority, voted to sell the town electric light plant.

AMES, IA.—At an election in this place recently, it was voted to establish a municipal electric light plant.

LEWISTON, N. Y.—The Lewiston & Youngstown Electric Railway Company will erect a power-house.

BLANCHESTER, O.—The citizens will vote April 18 on the question of issuing $18,000 water and light bonds.

SANTA ANA, CAL.—J. T. Buell, of Los Angeles, has made application for a franchise for a new electric plant.

MONTEREY, WIS.—The station of the Bower City Light & Power Company was destroyed by fire on March 18.

MARCELLUS, N. Y.—A Mr. Bond has been granted a 15-year franchise for the lighting of this village by electricity.

WOODBURN, ORE.—At the special municipal election the city decided to issue $10,000 in bonds to establish a water and light plant.

CLIFTON HEIGHTS, PA.—The Clifton Electric Light Company has decided to increase its capital stock from $50,000 to $100,000.

BUTTE CITY, MONT.—The Phœnix Electric Company has been granted a franchise to build its lines and conduct an electric light business.

PORT GIBSON, MISS.—An election will be held on April 21 to vote on the question of issuing $5000 in bonds to establish a civic lighting plant.

BROOKLYN, N. Y.—The Commissioners of Charities have recommended to the Board of Aldermen that all the buildings of the Charity Department be lighted by electricity.

BATH, ME.—A new lightship now being built at Bath, Me., is to be placed in Boston Harbor. It will cost about $50,000, and $5000 annually will be required to run the boat. Electricity will be used for lighting.

EAST LIVERPOOL, O.—The question of issuing $45,000 in bonds for the erection of a municipal electric light plant will be submitted to the voters of this city. The city is now paying $7000 a year for its street lights.

FALL RIVER, MASS.—The Fall River Electric Light Company has voted to purchase the stock of the Edison Electric Illuminating Company of this city. This will place the two concerns under one management. The capital stock of the Fall River Company will be increased from $200,000 to $350,000.

LAFAYETTE, LA.—The contract for the municipal electric light and water works plant at this place has been awarded to the firm of Raymond, Stearnes & Gray, 404 Carondelet Street, New Orleans, for $34,500. In our issue of March 21, it was erroneously stated the contract was awarded to the New Orleans Railway & Mill Supply Company.

BRONSON, MICH.—The electric light plant has just been completed by Rheubottom & Bond, of Union City, Mich. The plant is operated with a gasoline engine. The apparatus and materials for this plant were furnished as follows: Alternating-current dynamos, by the United Electric Improvement Company, Philadelphia; transformers, by the Wagner Electric Manufacturing Company, St. Louis, Mo.; meters, by the Diamond Electric Company, Peoria, Ill.; arc lamps, by the Helios Electric Company, Philadelphia; incandescent lamps, by the Buckeye Electric Company, Cleveland, O.; weather-proof and inside wires, by the Phillips Insulated Wire Company, Pawtucket, R. I.; engine, by the Otto Gas Engine Works, Philadelphia; and sundry supplies, by the Electric Appliance Company, Chicago.

The Electric Railway.

BRISTOL, PA.—The Borough Council passed an ordinance granting a right of way through the town to the Langhorne & Newton Railway Company.

TEMPLE, TEX.—The City Council has granted a franchise to a company of local capitalists who propose immediately to put in an electric street line.

KENOSHA, WIS.—The City Council has granted a franchise to the new electric railway company, which will build its line from South Milwaukee to this place.

LIGONIER, PA.—The recently chartered electric line, which takes in Latrobe, Derry and other nearby towns, will be extended to Idlewild and this place.

HAVERHILL, MASS.—The Haverhill, Georgetown & Danvers Street Railway has increased its capital stock to $60,000, and voted to build the road to Georgetown in the Spring.

BROOKLYN, N. Y.—The Nassau Electric Railway Company has secured permits to build extensions in Church Lane, Eighty-sixth Street and Fifth Avenue, Fourteenth Avenue and Bath Avenue.

GRAND RAPIDS, MICH.—Local capitalists are interested in a project to connect Grand Rapids, Holland and Grand Haven with an electric railway. The surveys have been made, and rights of way secured.

FAWN GROVE, PA.—The people of this place are beginning to agitate the question of constructing an electric railway from Fawn Grove *via* New Park to Stewartstown, there to connect with the Stewartstown steam railway.

WATKINS, N. Y.—The Watkins & Havana Railway Company proposes to increase its capital stock from $50,000 to $300,000. It is expected that the corporation will soon change its name to the Elmira & Seneca Railway Company.

AKRON, O.—There is talk of extending the Akron & Cuyahoga Falls Rapid Transit Railway to Cleveland. A meeting will be held in Akron, and the proposition to increase the capital from $600,000 to $1,000,000 will be considered.

KALAMAZOO, MICH.—The Kalamazoo street railway has been sold to a syndicate of local capitalists for about half what it originally cost. It is expected the line will be newly equipped. Several extensions are projected.

DAYTON, O.—The Dayton Traction Street Railway Company has let a contract for a power-house and complete electric line from this city to Miamisburg, a distance of 10 miles, for $250,000. The electric line is to be continued to Cincinnati, a distance of 60 miles, within a year.

GRAND RAPIDS, MICH.—Local capitalists are interested in an electric railway, which is to be built between this city, Holl and Grand Haven, connecting the Black Lake and Highland Park resorts. The surveys and right of way are all settled, and it is promised that the road will be built this year.

TRENTON, N. J.—Papers for the incorporation of a new electric railway have been filed in Trenton. The line will extend from Belmar to Spring Lake, and Manasquan. Capital stock, $50,000. President, A. B. Wilbur, Jr.; vice president, George W. Van Vanrahan; secretary, William B. Price of Newark.

DETROIT, MICH.—A syndicate consisting of H C. Burk, A. E. Riorelle, Charles W. O'Brien and Jas. T. Keena, are interested in a project to build an electric railway between Detroit and Toledo. Franchises have been secured from Detroit as far as Monroe, but nothing has been done as yet between Monroe and Toledo.

NEW HAVEN, CONN.—The Selectmen of the town of Vernon have voted to allow the Hartford, Manchester & Rockville Electric Railway Company to extend its tracks four miles to Talcottville. This is preliminary to a further extension to the City of Rockville. The new line will parallel closely the New England steam railway.

ELKTON, MD.—The Rising Sun, North East & Elk River Electric Railway, of Cecil County, was incorporated by James Mallon, Andrew Anderson, A. L. and E. L. Duyskinck, George W. Cosden, W. L Mearns and M. E. Kirk. Capital stock is $30,000. The road will run from Rising Sun by way of Bay View, northeast to a point on the Elk River, near Hyland's Store.

GREENWICH, CONN.—The incorporators of the Port Chester & Glenville Tramway Company, recently organized, will make application to the Selectmen of Greenwich for approval of the layout of a proposed freight trolley line from Port Chester to Glenville. The road is intended to carry freight between the mills at Glenville and the freight station of the Consolidated Road at Port Chester.

KANSAS CITY, MO.—The Metropolitan Street Railway Company has completed plans for a new central power-station, where will be generated the electric power necessary for the operation of all the lines in the western part of the city and in Kansas City, Kan. The dimensions of the building will be 145 x 126 feet, and about equal to three stories in height. The building will be divided into two sections by a brick wall. The boiler room will contain 16 boilers. The dynamo capacity will be 5000 horse-power. The boilers will be fed with fuel by automatic stokers, the coal being conveyed from the cars to the overhead reservoirs by mechanical carriers. The plant it is said will cost about $300,000.

MONTREAL, CANADA.—Mr. J. F. Hill, Comptroller of the Montreal Street Railway Company, tendered his resignation on March 4. Mr. Hill had been connected with the company since 1892, the first six months of which period were spent in constructing the present system of accounting, which has gained him such a wide reputation. Mr. Hill was formerly construction accountant for the Canadian Pacific Railway and subsequently accepted the position of accountant for the Works Department, of Toronto, which he left to accept that of Comptroller for the Montreal Street Railway Company. On the last day of his connection with the company the employees of the railway company's offices presented Mr. Hill with a costly gold watch and chain, suitably inscribed. Mr. Hill will hereafter be located in Chicago.

Trade and Industrial Notes.

THE UNIVERSAL ELECTRIC COMPANY, 739 Cedar Avenue, Cleveland, O., reports that its entire factory was destroyed by fire on the 16th inst.

THE KENSINGTON ENGINE WORKS (LTD.), of Philadelphia, Pa., have recently sold three 100-hp return tubular boilers of 125 pounds working pressure to the Haddon Hall Hotel, Atlantic City, N. J. Also a 200-hp feed-water heater of special design to the Atlantic Refining Company, of Point Breeze, Pa

SHEET-STEEL PULLEYS.—Watson & Stillman, 204 East Forty-third street, New York, have for some little time been at work upon a lot of hydraulic machinery for the new American Pulley Works of Philadelphia, which is to manufacture a new all-sheet-steel pulley, in which the hub, spokes and rims are all made of thin sheet steel.

JOHN WEDDERBURN & CO., patent solicitors, Washington, D. C., have awarded a prize of $150 to Mrs. Lottie Cox, of Blue Springs, Neb., for the best and simplest invention submitted to the firm. For the past year this firm has been carrying on monthly competitions for the best and simplest inventions, and Mrs. Cox is the first woman who has succeeded in capturing the prize.

THE FALK MANUFACTURING COMPANY, Milwaukee, Wis., has issued a pamphlet descriptive of its system of welding rail joints. The method consists of casting a mass of metal around the joint at a temperature sufficiently high to unite with the steel rail, practically making a continuous rail. The process is illustrated by half-tone cuts. Testimonials from several of the largest street railway companies speak very favorably of the joints.

STERN & SILVERMAN, 707 Arch Street, Philadelphia, have contracted with the Dayton Traction Company, of Dayton, O., for the building of its line from Dayton to Miamisburg, O., a distance of 12 miles. The contract calls for the furnishing of the road-bed complete with bridges, cars, trucks and motors, Corliss engines, boilers, dynamos, and the erection of steel and brick car-barn and power station, all to be in operation by July 1, 1896.

THE ELECTRIC CONSTRUCTION & SUPPLY COMPANY, 26 Commerce Street, Montgomery, Ala., desires to obtain from manufacturers of electric railway apparatus and supplies, approximate prices of their goods to aid them in equipping an interurban electric railway. The road is to be six miles in length, graded, track laid and all the electrical equipment furnished. Further information can be obtained by addressing Henry C. Jones, care of the above-named company.

THE BATES MACHINERY COMPANY, Joliet, Ill, has issued a catalogue of the Cookson combination feed-water heater, purifier, filter and oil separator, also combination feed-water heater, purifier, filter, oil separator and condensation receiver. The catalogue contains various diagrams and illustrations of these devices and tables of dimensions, etc. The front cover bears a fac-simile reproduction of the patent granted to Mr. Thomas J. Cookson on the feed-water heaters and purifiers described. This gentleman, whose address is 59 Canal Street, Chicago, is manager.

THE MICHIGAN-PENINSULAR CAR COMPANY, of Detroit, Mich., have placed a contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for a new foundry building 160 feet square. This building is one story high, has a steel framework throughout, and is so designed that the lower cords of the trusses support runways extending the whole length of the building. These runways carry trolleys having a capacity of 2000 pounds. By means of these overhead trolleys the molten metal is conveyed quickly and easily from the cupolas to any part of the casting floor.

THE STEWART HEATER COMPANY, Buffalo, N. Y., has just issued a new illustrated catalogue of its tubular, sectional and open feed-water heaters and purifiers. The catalogue also includes the Otis double system or combination feed-water heater with automatic regulator, which devices are manufactured by the Stewart Company. The feed-water heaters and purifiers are guaranteed to heat the feed-water, extract oil, purify the water and separate the lime before it enters the boilers. According to a long list of testimonials printed at the back part of the catalogue these heaters and purifiers are giving general satisfaction.

UNDERGROUND CABLES.—The National Underground Cable Company has just received an order from the West End Street Railway Company, of Boston, covering all the lead covered underground feeder cable to be used by the latter company during the year 1896. The first work to be done on this contract will be for about 21 miles of 500,000 cir. mils cable and two miles of 1,000,000 cir. mils cable. The West End Company has been using for some time large quantities of the National Company's cable, and the giving of this order speaks for itself as to the satisfaction it has given. This contract of the

National Underground Cable Company covers also the laying and connecting of the cables in Boston, and the doing of all the work.

LUNDELL FAN MOTORS.—The Interior Conduit & Insulation Company, 527 West Thirty-fourth Street, New York, has issued a handsome and complete catalogue showing its line of Lundell fan motors for the season of 1896. These machines, some 20,000 of which are now in actual use, are so well known throughout the country that a description of them is entirely superfluous. Special mention, however, should be made of several new styles which are now offered for the first time, and particularly of the Lundell "White Wings," which is a decided novelty. This is a ceiling fan motor with aluminum blades, made in two sizes, and especially adaptable for low studded ceilings. The outfits are complete, efficient, of handsome design, and are of low price. New designs in suspended and bracket fan motors are also shown in the catalogue.

THE MIAMISBURG ELECTRIC COMPANY, Miamisburg, O., is one of the leading manufacturers of open-circuit dry batteries. The Imperial dry battery is free from all the weak points of many ordinary batteries of this class, and the company states that not a single complaint has been made of defective Imperial batteries during the past year. This is a commendable showing. The Burnley cartridge wet battery is largely used by leading telephone companies and giving good satisfaction. They have been adopted exclusively by some of these companies. The Miamisburg Company is now putting on the market its No. 3 battery for long-distance telephone work. This battery has been given a practical test during the past two years by some of the leading telephone companies, and is now extensively used by them in place of acid batteries.

THE RUSHMORE DYNAMO WORKS, Jersey City, N. J., are meeting with much success with their new projectors. It is admitted that every steam vessel would before this be equipped with search-lights had there been any reliable apparatus. The enormous power of the Rushmore lights, together with their simple construction and perfect performance, has overcome all prejudice which existed among seamen. The Rushmore works report that they have orders booked for equipping all the steamers of a number of lines on the coasts, rivers and great lakes, and are also replacing many of the common reflector lights previously sold, and that the factory is obliged to work night and day to keep up with its orders. They are the only search-light concern in the country making lenses, and their grinding plant is said to be the most complete in every detail.

SHULTZ SABLE RAWHIDE BELTING.—Mr. A. B. Laurence, manager of the Shultz Belting Company, 113 Liberty Street, New York, reports some excellent results in the use of Shultz's patent grooved sable rawhide belting in the station of the Ridgewood Electric Light & Power Company, Ridgewood, N. J. A six-inch endless double belt of this make, 54 feet 8 inches long, has been in use since September, 1893. The belt, which runs slack, couples a Watertown engine to a T.-H. 750-light alternating dynamo, running at a speed of 4385 feet per minute and transmitting 75 hp. The engine pulley has a diameter of 60 inches and that of the dynamo 11 inches. The speed of the pulleys are 280 revolutions per minute and 1525 revolutions per minute respectively. Shultz's patent sable rawhide belts were substituted for two 23-inch leather belts at the Metropolitan Life Building, Madison Square, New York City. They have been running since October, 1895. One of them is carrying a 3000-light load and has not been shortened since put on. The dynamo pulleys there are covered with Shultz's patent leather pulley covering, which is well spoken of. Among other plants using Shultz's rawhide belting may be mentioned those of the Sun Fire Insurance Company, 54 Pine Street; Central Opera House, 205-223 East Sixty-seventh Street, and the Young Women's Christian Association, 7 East Fifteenth Street. Mr. Laurence reports that a 20-inch Shultz dynamo belt has just been shipped to Venezuela, to transmit power from a turbine to a dynamo.

PERSONAL.

MR. W. D. WEAVER, for nearly four years connected with the editorial department of THE ELECTRICAL WORLD, has purchased an interest in *Electrical Industries*, and will hereafter devote his services to that publication. *Electrical Industries* is a monthly, devoted to the popular side of the electrical business, and has heretofore been published at Chicago. In future it will be issued from New York under a new name and in another form. Those who know Mr. Weaver and the intelligent and conscientious work he has done on THE ELECTRICAL WORLD will join us in heartily wishing him abundant success in his new undertaking.

Business Notices.

AN INVENTOR can have a practical, patented, electrical novelty placed on the market by communicating with Box 676, Syracuse, N. Y.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 24, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

556,763. TELEPHONE SWITCH; W. A. Moore, Brooklyn, N. Y. App. filed Sept. 5, 1895. The combination in a telephone switch of one or more contact points, a finger-lever, a sliding hook, an elbow lever interposed between the finger-lever and the sliding hook, and positive continuous connections from said finger-lever to the elbow-lever, and from the elbow-lever to the sliding hook all arranged and combined to operate.

556,769. ELECTRODE FOR SECONDARY BATTERIES; O. Pirsch, Liege, Belgium. App. filed March 11, 1895. A conductive core for storage-battery electrodes, constructed of thin sheet-lead and provided on both faces with outwardly-flaring tubular projections, having radially diverging and overhanging teeth or branches, the rows of projections on one face substantially occupying the space between the rows of projections on the opposite face.

556,773. BLOCK SYSTEM FOR RAILWAYS; B. C. Rowell, Boston, Mass. App. filed Dec. 16, 1893. In combination, two opposite signal-apparatuses, mechanism connecting them, and keeping them always in opposite positions, and an automatic shifting apparatus operated by the passage of a train and operating their connecting mechanism to shift the opposite signal apparatuses.

556,782. SECONDARY BATTERY; M. Sussmann, Neu-Ruppin, Germany. App. filed May 15, 1895. An electrode for secondary batteries, comprising a sheet metal conductive core and an active material consisting of a paste composed of plumbic material and pumice stone in a finely divided state, and a solution of rubber.

556,788. OPERATING DYNAMO ELECTRIC MACHINES IN MULTIPLE; E. Verstraete, St. Louis, Mo. App. filed Sept. 1, 1894. The combination with a generator having series field-coils, and field-coils in shunt relation to the armature, of another generator supplying the same circuit in multiple, having a set of shunt field-coils energized by current taken from opposite sides of the armature of the first generator.

556,823. AUTOMATIC GROUNDING DEVICE FOR ELECTRIC CONDUCTORS; G. A. Jewett, Chicago, Ill. App. filed July 8, 1895. The combination with a suspended electric conductor or wire and a support to which said wire is attached, of a spring arm secured to the support and resting at its outer end against the wire, electrical connections between the spring-arm and wire, and a stationary part electrically connected with the ground and terminating in close proximity to the spring-arm, the latter being adapted to move into contact with said stationary part when unsupported by the wire.

556,862. CONTROLLER FOR ELECTRIC MOTORS; E. D. Priest, Schenectady, N. Y. App. filed April 9, 1895. A controller for electric motors, comprising a reciprocating resistance switch, a separate reciprocating series-parallel switch, and permanently connected means for operating the two switches simultaneously from a single handle.

556,864. TROLLEY SUPPORT; E. B. W. Reichel, Gross-Lichterfelde, Germany. App. filed Sept. 3, 1895. In a trolley support, the combination with a trolley-arm adapted to oscillate only in a plane parallel with the line of travel of the car, of yieldingly-mounted pivot or journal for said trolley-arm, and symmetrical opposite springs, attached to said trolley-arm and adapted to exert their greatest leverage thereon when said trolley-arm is in a vertical position.

556,865. ALTERNATING-CURRENT SYSTEM; E. W. Rice, Jr., Swampscott, Mass. App. filed Jan. 24, 1894. An electrodynamic machine of the three-phase type, having its different armature coils wound with wire of different sections corresponding to the strength of current they are designed to generate.

556,866. ELECTRIC ELEVATOR; E. W. Rice, Jr., Schenectady, N. Y. App. filed April 2, 1890. The combination with an elevator car or lift, of an electric motor operated on a short circuit as a generator by the car in descending, electric controlling devices under the control of the attendant on the car for governing the speed of movement of the motor when moving in either direction, and a mechanical brake for stopping the car when the controlling devices are in an intermediate position where the electric controlling devices are in position to bring the motor to rest.

556,870. WIRE GAUZE BRUSH FOR DYNAMOS OR MOTORS; A. B. Soar and E. W. Collier, London, England. App. filed Dec. 7, 1895. An electrical contact or commutator brush comprising superposed layers of corrugated wire-gauze, the said layers being compressed together to constitute practically a solid brush.

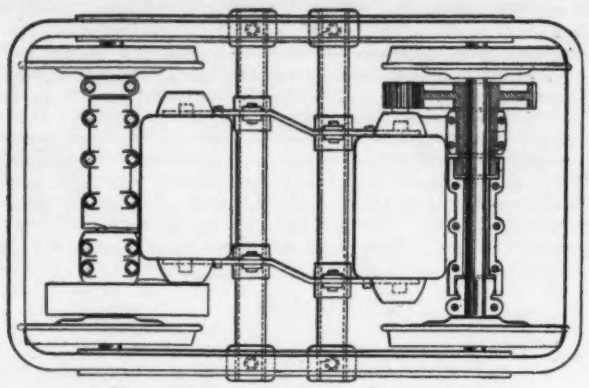
556,876. CLIP FOR TROLLEY WIRES; R. H. Beach, East Orange, N. J. App. filed April 17, 1895. The combination with two clamping members, provided at both ends and intermediate the latter with corresponding projections or lugs having pivotal connection to unite the said members, grooved along the lower ends to receive the trolley-wire between them, and also formed along their upper edges with tapering grooves to receive between the members a securing device, of a tapering securing rod or pin fitting said tapering grooves and having bearing within said grooves at both ends of the members as well as intermediate the ends, to prevent the springing of the members.

556,882. DEVICE FOR PLACING ELECTRIC BLASTING FUSES; R. H. Elliott, Birmingham, Ala. App. filed July 13, 1895. In an igniting device for use in blasting, the combination with an electric fuse of flexible wires connected to said fuse and covered with flexible insulating material for a short distance from said fuse, and a rod made of insulating material, and enclosing the portion of said wires adapted to lie in the bore-hole and terminating a short distance from the fuse.

556,891. SUPPORT FOR FIELD MAGNET COILS; B. G. Lamme, Pittsburg, Pa. App. filed Sept. 4, 1895. A coil-supporting bracket or hanger for compound-wound field-magnets, comprising a main or body-portion, two integrally-formed outer flanges and a plurality of intermediate flanges or fingers.

556,893. ELECTRIC CAR TRUCK; E. Lundqvist, Pittsburg, Pa. App. filed July 31, 1895. In an electrical locomotive the combination of a motor solely supported on the truck-frame, a gear-wheel rotatively mounted in a bear-

ing in the motor-frame and in mesh with a pinion on the motor shaft, an axle connected with the gear through a flexible joint consisting of a loose sleeve surrounding the axle, one end of which is flexibly coupled to the gear-wheel, and the other similarly coupled to the axle, the gear-wheel having a clearance all round the axle sufficient to allow the axle to move freely in all directions. (See Illustration.)



No. 556,893.—Electric Car Truck.

556,894. LIGHTNING ROD BALL; E. K. Hum, Pittsburg, Pa. App. filed Jan. 5, 1895. A silvered glass lightning rod ball, having an interior coating of asphaltum, varnish, paint or like material over the quicksilver, as well as between the outer surface of the ball and the locking-cap, whereby both the quicksilver is protected and the said flanges united to the ball by a harmless cement.

556,898. ELECTRIC ARC LAMP; G. C. Pyle, Indianapolis, Indiana. App. filed May 2, 1895. In an arc lamp, a lamp-post, a lever supported by such post and having on it a trough-shaped bracket, and a holding bar for the upper electrode, having a pin thereon that fits in the bracket on the lever.

556,901. THERMO-EXPLOSIVE CARTRIDGE; C. H. Rudd, Chicago, Ill. App. filed Dec. 26, 1893. In an electrically-exploded cartridge, the combination with an inclosing shell, of substances contained therein which do not explosively combine at initial temperature, electrical conductors embedded in said substances to uniformly heat the same throughout, a fulminating cap and an electrical igniter therefor. (See Illustration.)

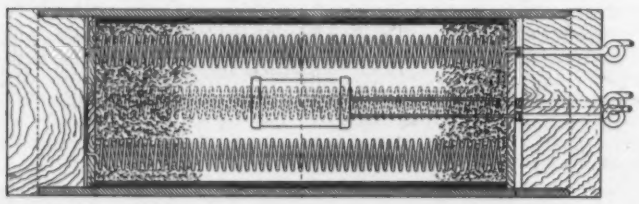
556,902. ELECTRICAL DETONATOR; C. H. Rudd, Chicago, Ill. App. filed Feb. 3, 1894. The combination with explosive material of fusible conductors for igniting said explosive material included in an electric circuit in series, and a shunt or by-path about each of said fusible conductors for carrying current to the conductors last to fuse.

556,903. ELECTRICAL DETONATOR; C. H. Rudd, Chicago, Ill. App. filed Feb. 3, 1894. The combination with explosive material of an igniting conductor in an electrical circuit, a shunt or by-path about said igniting conductor and means for opening the circuit through said by-path to cause an increased flow or current through said igniting conductor.

556,904. ELECTRICAL DETONATOR; C. H. Rudd, Chicago, Ill. App. filed Feb. 3, 1894. The combination with explosive material, or heating coils, and an igniting conductor in a common electrical circuit, and means for passing the heating current through the heating coils, and an igniting current through the igniting conductor.

556,941. TROLLEY ATTACHMENT FOR ELECTRIC CARS; F. S. Smith, Hartford, Conn. App. filed June 11, 1895. The combination with the trolley arm and its pivot of a rod pivoted to the trolley arm and a support through which the same passes, a cross-head sliding on said rod and a hook carried by the cross-head and springs acting upon the cross-head, a pawl upon the trolley arm for engaging the hook, a flanged wheel at the end of the trolley arm to bear against the elevated conductor, and mechanism intervening between the flanged wheel and the pawl for holding such pawl, and for liberating the same when the flanged wheel does not bear upon the conductor.

556,945. REGULATING DEVICE FOR CONTROLLING WORKING OF ELECTROMOTORS; R. Thury, Geneva, Switzerland. App. filed Feb. 3, 1896. The combination of a hand-lever with a segmental rack acting on one hand upon a pinion bearing two switch arms and on the other hand by means of its arm upon a forked arm, of a switch in combination with external and internal contact pieces which are disposed concentrally to the axis of the pinion in view of putting into the circuit of the electromotor, a variable number of resistances and with contact-pieces disposed concentrally to the axis of the switch in view of reversing the direction of the electric current in the induced coil of the electromotor.



No. 556,901.—Thermo-Explosive Cartridge.

556,946. ELECTRIC SIGNAL LAMP; A. F. Ward, Memphis, Tenn. App. filed June 21, 1895. A signal device comprising a dynamo, a hand-driven mechanism thereof, and an enclosing protective casing, in combination with a folding mast carried by said dynamo-casing and a signal lamp at the upper end of said lamp.

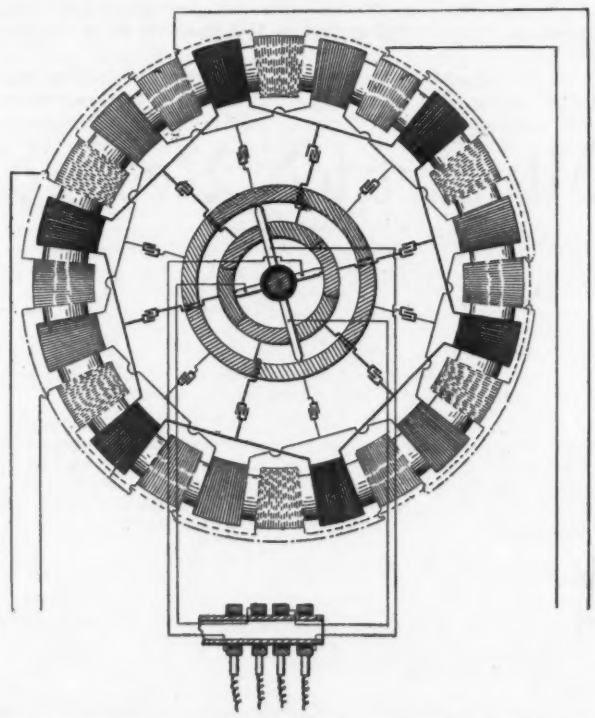
556,959. MEANS FOR ATTACHING AND DETACHING ELECTRIC LAMPS; F. A. Butterfield, Detroit, Mich. App. filed June 1, 1895. A device for attaching and detaching incandescent lamp bulbs, consisting of a conical casing, having gripping material on its inner face, yielding jaws projecting over and above the upper end of the casing, and a handle at the opposite end of the casing.

556,967. ELECTRICAL CONNECTOR; P. H. Fielding, New York, N. Y. App. filed July 9, 1895. A stage or floor pocket consisting of a tube of insulating material set into the floor or wall, having a free passage through it and provided internally with electrical contacts located against opposite sides and in different planes, so as to be diagonally opposite each other, in combination with a plug of insulating material adapted to enter the tube and provided exteriorly with bands of conducting material adapted to contact respectively with the contacts in the tube.

556,971. INSULATED SUPPORT FOR CONTACT RAILS; A. Hanson and J. R. Chapman, Chicago, Ill. App. filed Oct. 30, 1895. The combination with insulated supports comprising each a standard or base, and a rail-support mounted thereon and insulated therefrom, of guard-planks carrying keys or wedges and vertical slots provided upon said rail supports for the reception of said keys or wedges.

557,008. ELECTRIC TROLLEY; G. R. Mitchell, Newtown, Pa. App. filed Nov. 22, 1895. In an electric trolley the combination of a supporting arm, a current-collecting device carried at the free end of the arm and adapted to make a running contact with the under service of a suspended conductor, a flexible guide-frame also carried at the free end of the arm and extending to the front and to the rear of the current-collecting device, and grooved guides carried upon the free ends of the flexible guide-frame, whereby they are respectively arranged to the front and to the rear of the current-collecting device.

557,015. TROLLEY FOR ELECTRIC RAILWAYS; P. F. O'Shaughnessy and O. T. Crosby, New York, N. Y. App. filed Sept. 27, 1888. The combination with an electric railway car of a trolley for making an underneath contact, and telescopic support for said trolley on the roof of the car and means extending within reach of the operator for adjusting said trolley.



No. 557,094.—Converter of Frequency for Alternating Electric Currents.

557,037. ELECTRICAL CONNECTOR; B. L. Toquet, Westport, Conn. App. filed Dec. 28, 1895. A joint for electrical conductors consisting of a tube fitting over adjoining ends of the conductors, both tube and conductor ends being indented, widened and crushed together at points.

557,048. ZINC SUPPORT FOR BATTERIES; H. J. Brewer, New York, N. Y. App. filed June 9, 1894. The combination of a zinc pencil, a battery jar having a lip, the projecting spout integral therewith, and a detachable zinc support having two downwardly-projecting arms engaging with the two sides of the spout of the jar.

557,049. MEANS FOR SUPPORTING MOTORS AND MOTOR-FRAMES; E. S. Breed, New Britain, Conn. App. filed April 22, 1895. The combination with a truck-frame, a pair of wheels therefor, their axle, of a centrally-located motor-supporting frame suspended solely from the side beams of the truck-frame longitudinally arranged and independent bars included in the motor frame, an electric motor centred on the axle at one end, and movably connected between its front and its rear ends with the said longitudinally arranged bars, said bars being movably secured to said motor-frame.

557,094. CONVERTER OF FREQUENCY FOR ALTERNATING CURRENTS; M. Hutin and M. Leblanc, Paris, France. App. filed March 13, 1894. The method of transforming an alternating electric current of one periodicity, into an alternating current of another periodicity, which consists of successively and continuously changing the points of line connection in either direction around a commutator apparatus. (See Illustration.)